EDITORIAL

IN the October issue of last year, I protested as nicely as I could against the attempts by some sections of the radio trade to sell the 17in TV set as the optimum and ideal size for Australian conditions.

And did I get into hot water!

It was said that I was damaging the sales of receivers by an ill-timed attack on the 17in screen which was big enough anyhow, and that I should not have printed such remarks which were ill-informed.

Quite obviously, many of my critics had not read my actual words. They merely assumed I had said that 17in sets were no good, and advised our readers not to buy them, but to wait were largely destructive.

In the light of today's position, it is interesting to back check.

In October, I said that, in my opinion, if there was such a thing as optimum size, it would be 21 inches, and that this had been borne out by overseas experience. That there was a place for every screen size, "from the 9in midget to the 27in mammoth", but that buyers would be disillusioned when, after having being told that their 17in sets were the last word, they found 21-inchers coming on the market, and could see the difference for themselves.

And haven't they?

The radio trade is very worried at the moment by the slow movement of TV sets. I have asked many people — salesmen, executives, engineers—why business is not better.

And the reasons, given in order, are that buyers are waiting for 21in screens, that prices are too high, and that programs are not good.

What has the radio trade done to improve the position?

It has brought out 21in receivers as quickly as it could, and it is reducing prices. Some of those 21in sets were on the way even before I was taken to task for my comments about the 17-inchers!

As to programs, you must judge for yourselves.

Today manufacturers are planning for majority sales in the coming months of 21in screens.

Mr. S. O. Jones, technical director of Philips, said recently before a tariff board inquiry that screen sizes of better-class home receivers would increase, and that screens of less than 17 inches would come on the market for portables and cheaper home sets. In other words, we will eventually have the lot.

Isn't that virtually what I wrote last October?

It was not a good move to restrict, even for a start, the specifications for Australian TV sets. To sell TV here, we must adopt 1957 standards, and not those of the past. If we don't, we cannot be surprised if our TV progress begins to sag in the middle.

John Moyle

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RADIO ★★ TELEVISION AND HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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Vol. 19 No. 1

SUBSCRIPTION RATES
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OUR COVER PICTURE

Control rooom of the BBC's new London transmitter at Crystal Palace. Looking into the transmitter hall. There are two 15 Kw vision transmitters and two 4½ Kw sound transmitters.

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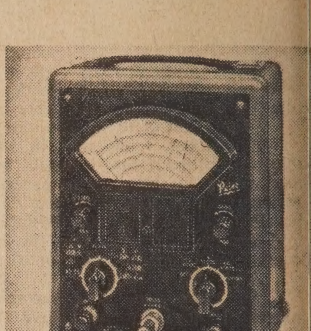

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MODEL M52. Fifty-two range Laboratory Multimeter:—1,000 O.P.V.
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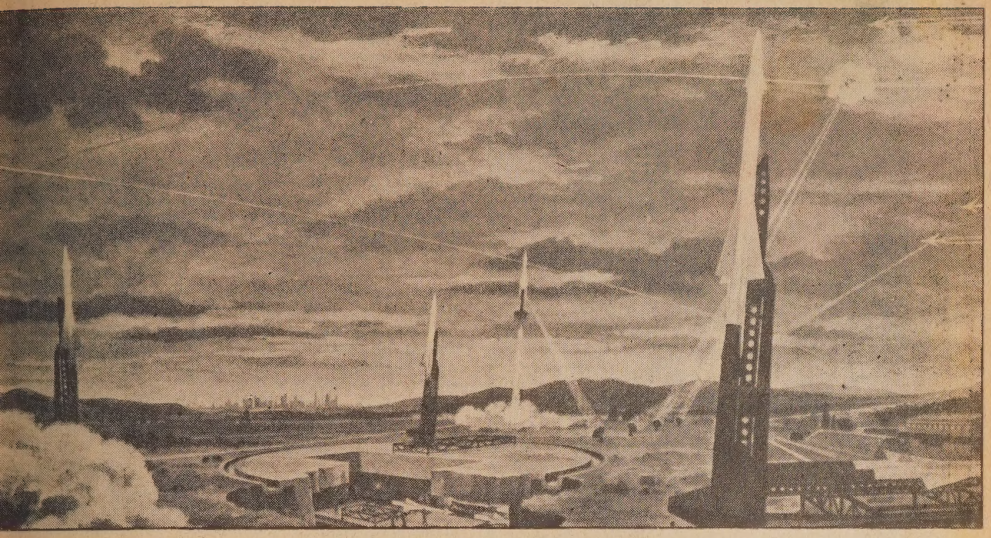
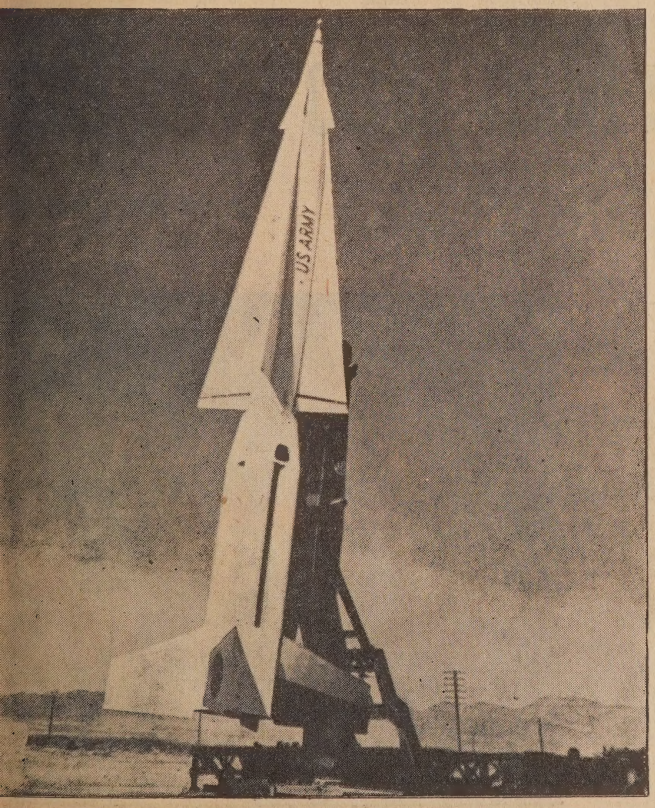


An artist's impression of the way guided missiles might be used to protect a city. The rockets shown are Douglas Nike types.



BALLISTIC engineers have come a long way toward their aim of controlling atomic explosions since the first big bombs tore the heavens to pieces over the Pacific.

Today it is possible to manufacture warheads which are safe enough to use at much closer quarters, and to combine them with rocket motors into missiles for offence and protection.

At the left is shown the latest of American missiles in a picture only just cleared for publication.

The picture at the top of the page shows how an artist imagines a defence set-up in which missiles of this kind are used to intercept large aircraft on bombing missions.

The missiles are guided from the ground by radio signals, their courses being determined by rapid computors in the underground headquarters of the defence unit.

The missiles themselves are stored underground and loaded automatically as required.

Latest release by the US army is this picture of the Nike Hercules, an anti-aircraft missile with an atomic punch. It was made in January at the White Sands proving ground. The Hercules is bigger, faster and has a longer range than the Nike Ajax, the type now used in guarding many of the nation's key cities. The Hercules is expected to be ready for use soon.

John Logie Baird taken at the time of his early experiments.

But it is well worth remembering that, despite the c materials and methods he was forced to use, his inger and imagination were such that he found a way to d these things with varying degrees of success.

We are so used to using electronic methods today it's hard to imagine a time when a cathode-ray tube cou be had for love or money, when an electronic TV ca hadn't even been dreamt about; or when the only tran ters available for TV operated on the broadcast band.

But this was the position when Baird, together other pioneers the world over, were beating out the which ultimately led to the establishment of the world's gest industry.

The story of Baird in many ways is the classic tragic history of the pioneer who started something too for him to finish.

MECHANICAL METHODS

Baird's first TV efforts were mechanical because could be no other way. Some electrical training ir early life allowed him painfully to progress, passing thr his discs firstly light and shade, then fairly clear silhou and finally legitimate pictures graduated in light and sha

Eventually he realised the futility of persisting very coarse lined pictures, and with the many difficultie herent in the mechanical system.

But, although he lacked the resources and facilit develop an alternative method, his competitors did not was the EMI electronic system of TV which finally ran deathknell of mechanical methods. The cathode ray could handle picture scanning problems with an ease the discs and mirror drums could not match. Elect picture tubes solved all the problems, which earlier had found unsurmountable.

When the BBC agreed to op regular, although limited broa using the Baird TV system, B future looked bright. It was the spot in his career.

Baird- The Man Who Was Firs

The man to whom the invention of television is generally attributed is John Logie Baird. But, in fact it is hard to say who invented it, for it was made possible by the ideas of many men. It was Baird who gave the first demonstration of the true TV, but even he used as the essential ingredient of his picture production the disc system invented by Nipkow.

BY THE EDITOR

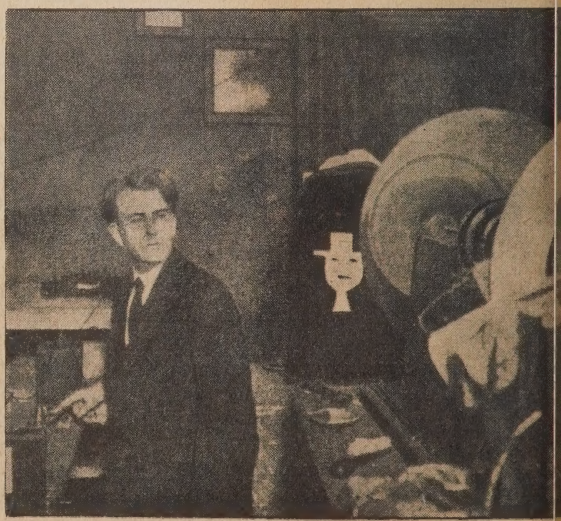
IN fact, Nipkow's principle of scanning the TV picture line by line and reassembling it by a similar method at the receiving end is still the basis of our modern electronic TV, although the mechanical spinning disc has now long gone into the discard.

Today we do wonderful things with our TV. We can send pictures in color, we can display big pictures on theatre screens, we can record our programmes and play them back again, without films, we can transmit film programmes, and we could even send 3-D TV if we felt so inclined.

What wonderful advances the modern scientist has given us to be sure!

And yet, if we but remember it, John Logie Baird, using variations of his mechanical disc and mirror drum systems, did every one of these things in the early stages of his experiments, even before, by arrangement with the BBC, he broadcast the first TV programmes in the world.

There is no shadow of doubt that the results we can get today are infinitely superior to anything Baird ever did.



With this apparatus, Baird was able in 1925 to demonstrate the tranmission of outlines in black and white at Frith St., London.

But, even in his moment of triumph, it was obvious
t his efforts were bound to fail against the competition
m the electronic system, which steadily and surely solved
difficulties one by one.

The B.B.C.'s decision to abandon the Baird transmis-
ns in favor of those provided by the EMI method marked
end of Baird's productive efforts in TV. The initiative
d been taken from him and the reason was simple—what
had to offer was no longer good enough.

To do Baird justice he knew as well as anyone that the
C's decision was inevitable. But that did not make the bitter-
ss any less easy to endure. From that point he became merely
competitor, among others, of an organisation far too big
him to fight, and the Baird company eventually dis-
peared.

Baird himself died a few years later, a tired and disillu-
ned man, a little bewildered with the world and his
't in it, an honored figure, but a rather tragic one.

Baird's early TV systems, and those of most of his con-
nporaries, used the Nipkow disc, which had a spiral ar-
ngement of holes near the outer edge through which a
ht shone upon the televised object.

SC SCANNING

When the disc was spun, the dots illuminated the object
a series of lines, each one a little below the one before,
that the object was "scanned" in the now familiar manner.
nen the last line of light completed its scan, the disc had
mpleted a revolution, and the process began over again.

There were 30 such lines for each revolution, and the
c turned 12½ times each second.

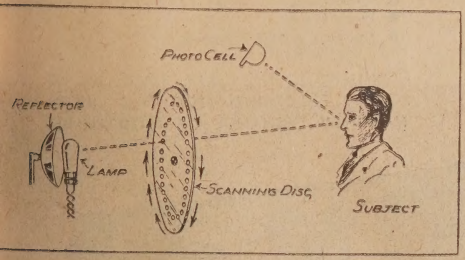
Placed near the object was a photo-electric cell, or more
n one, which registered the light reflected from the tele-
ed object as it was scanned. The currents from this cell
re sent out over the transmitter and thence to a receiver
h a second disc revolving at the same speed as the first. A
on tube was energised by the receiver, and the variations
its light output when viewed through the scanning disc
re a duplicate of the picture seen at the transmitter.

Improvements and variations of this system were
opted, but the broad principles remained.

One would have imagined Baird would have been well
upied working out schemes for better and brighter pic-
es.

But his mind was working away ahead of his immediate
ievements, and he was soon thinking out new ideas.

One of these was a method for televising films, particu-
y the talking fiims, which had come into being about this
e.



iagram showing how the scanning disc works. The light
flected from the subject was picked up by the photo-electric
ell. The disc scanned the subject in a series of light lines
drawn by the movement of the holes in the disc.

Baird's method was to project the picture from the film
ctly on to the scanning disc, so that it occupied an area
ch would allow it to be scanned as the disc revolved.

Behind the disc was the usual photo-electric cell, which
orded the varying light intensity of the film image, frame
frame.

This method of film scanning was actually more suc-
ful than direct televising, because it was possible to con-
trate considerable light upon the small film picture, and
right image could be obtained even with only one photo-
tric cell as against up to three used for direct work.

Synchronising was obtained by using an aperture gate,
ch produced a short time period during which there
no scan. The signal representing this period of dark-

The first Television Photograph ever taken
This is an actual untouched photo of
the image as it appeared on the screen
of the first "Televisor"

An historic photograph taken in 1926 when Baird gave his first demonstration of true television.

ness was used very succesfully for synchronising in these early TV systems.

As with the talkies themselves, early efforts called for separate sound channels from disc records, but the universal adoption of the sound track carried on the film itself made the extraction of the sound for TV a simple matter. Incidentally it was general practice in the early days to broadcast TV sound on a separate wavelength from that used for the picture. Remember that the broadcast band was being used, something possible only because of the very small number of picture elements involved.

Two untouched photographs of images from the Baird Televiser of 1928. Note the improvement over the picture at the top of this page.

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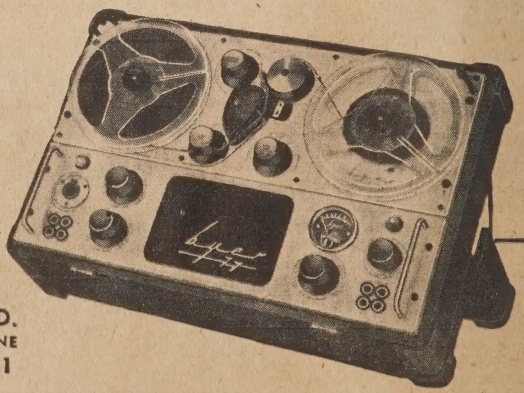

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VICTORIA MX5171

But there it was—filmed TV!

Baird's hopes for film TV were very great, and he employed a method of rapid film use quite similar to that used today.

A large loop of film ran continuously through a camera, through developing, washing and fixing tanks, through a drier, and finally through a TV transmitter. It was then cleaned of its emulsion, resensitized, and passed once more through the camera. The whole process occupied only a few minutes.

It was an ingenious idea, but it only emphasised the limitations of early direct viewing systems, and their inability to handle optical problems which the camera found an easy matter.

DIFFICULTIES OF LIGHTING

One of the greatest hardships endured by early TV artists was to sit under powerful arc lights for a broadcast.

The limited field of vision of the early "cameras" and their relative insensitivity demanded studio conditions which were almost intolerable. Great banks of high-powered lights were poured on to supply the illumination.

Baird, in seeking a solution, experimented with the use of rays other than light rays, including both ultra-violet and infra-red.

As might be imagined, ultra-violet illumination posed many difficulties when put into practice, and was soon abandoned in favor of infra-red.

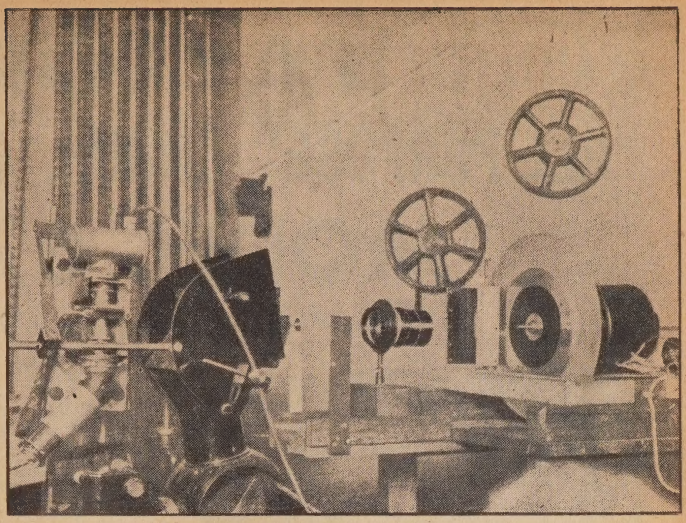
These rays were generated from an ordinary bank of floodlights, but the visible rays were filtered through sheets of thin ebonite, which effectively blocked them while allowing a large proportion of the infra-red to penetrate.

By selecting suitable substances for the photo-electric cells which had a high response to the infra-red, and modifying the normal optical systems, Baird was able to obtain useful images of people sitting in complete darkness.

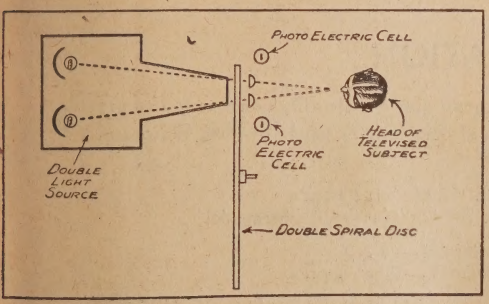
The idea was of little use in solving the heat and light problem, for as an early writer observes, "It was generally inconvenient for the subject to sit in total darkness!"

THE NOCTOVISOR

However, Baird was obviously intrigued with the possibilities of seeing in the dark by TV, and developed the "Noctovisor" first demonstrated in August, 1929. This was a rather crude device, for it did not claim to televise pictures in the dark. But it could respond to the infra-red component of any light which shone its way, and was able to locate the presence and bearing of a car's lights when shielded from the direct ray by a sheet of the ubiquitous ebonite.



This is the apparatus with which Baird made his first demonstration of televising talking picture films.



☆

Stereoscopic TV was possible by this two picture system using a double row of holes in the disc. A special viewer was needed to separate the images at the receiving end.

☆

Great things were predicted for this device, particularly in locating ships hidden in dense fog at sea. Baird couldn't know that the same electronics which shattered his mechanical empire would also produce a radar system that would in fact televise the image of targets more accurately than he could have dreamed.

Large screen TV was a subject upon which Baird was extremely active, and with which, as the result of prodigious labors, he achieved considerable success.

The general idea was a simple one, but the implementation wasn't so easy.

Realising that it was obviously impossible to light up a big screen by using the limited light from neon type lamps and Kerr cells, Baird's scheme, patented in 1933, was to arrange a large commutator to revolve in synchronism with the transmitting disc. This commutator, operating as a huge switching device, would light and extinguish a great battery of electric lamps arranged over the face of a screen, each lamp representing a picture element.

The lamps were lit by the current from a powerful amplifier, so that the light and dark portions of the picture were built up to correspond with the scanning of the transmitter.

LARGE SCREEN TV

The first successful screen demonstrated by Baird was in July, 1930, and it had 2100 tiny lamps, each set in a separate cell. For each lamp there was a bar on the commutator, and the switching operation for the entire 2100 lamps occupied only 1/12th of a second. The commutator revolved at 750 rpm, so that more than 25,000 contacts were made and broken every second.

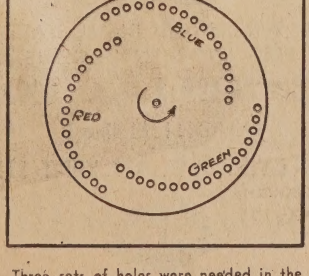
Naturally this commutator and its wiring was a massive affair!

The time lag in the lamp filaments proved an advantage in providing a bright picture, and in reducing flicker. Public demonstrations of this screen were some of the most successful and dramatic things Baird ever did.

The latest achievement of modern TV is to send pictures in color. It is perhaps the most spectacular piece of engineering the electronic world has yet seen. But Baird, with his crude apparatus, gave his first color TV broadcast in July 1928.

By a curious twist of fate, a method using rotating discs not essentially different from Baird's was the first to be

(Continued on Page 105)



Three sets of holes were needed in the disc for color work, each transmitting a primary color by means of filters.

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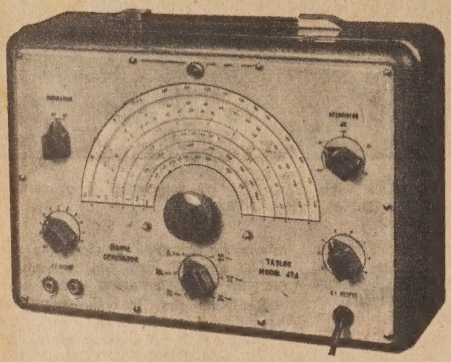

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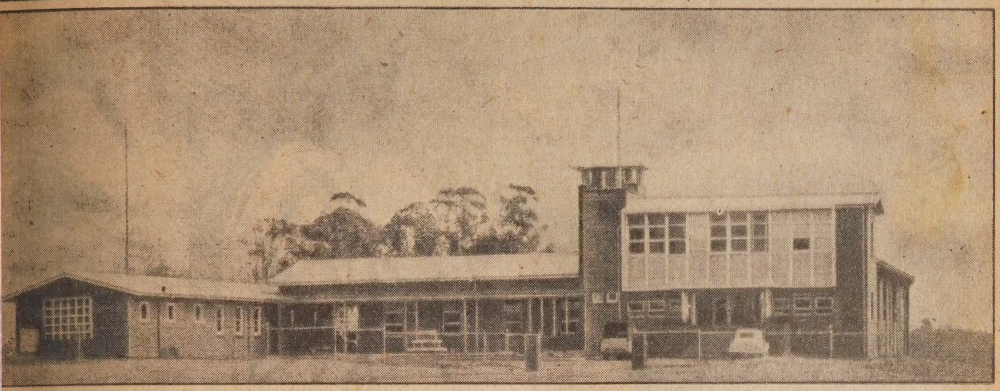
PENNANT HILLS NOW A MEMORY



his is the transmitting station at Doonside, about 20 miles from Sydney, set in a maze of rhombic aerials that cover 740 acres.

On February 28 of this year, a brand new transmitting centre was opened at Doonside, about 20 miles from Sydney. It replaces the historic installation at Pennant Hills which has been in operation there for nearly half-a-century. Thus passes a famous name in the history of Australian radio, and ends the usefulness of a landmark known to most of the city's population.

HE tall masts of Pennant Hills, rising from grassy slopes where skylarks g and the wind whipped through the es were a familiar sight to motorists their weekend jaunts, and to picnickers in the vicinity in the days when motor cars were a novelty.

Their very silence and remoteness gave color to the idea that somehow they had always been there, and were likely to stay that way until the end of time. For even on the inside, a radio station is not a dramatic place—it has no air of wearing out, rusting out, or fading away.

But the passing years were at work among its once shining racks and cabinets; the insidious and rapid growth of new things made its valves old-fashioned, and its services out of date. Replacements and additions could not keep the pace, and eventually the old had to make way for the new.

Soon, no doubt, those tall masts will be tumbled down, the spells of half a lifetime will be broken, and the fields given over to buildings, houses, and to children.

The very first coastal radio station went into action in 1910, and was located on the roof of the Hotel Australia in Castlereagh St., Sydney.

It's hard to remember now whether Pennant Hills was the first of the high powered Coastal and Defence radio stations, but it was opened in 1912, together with another in Perth.

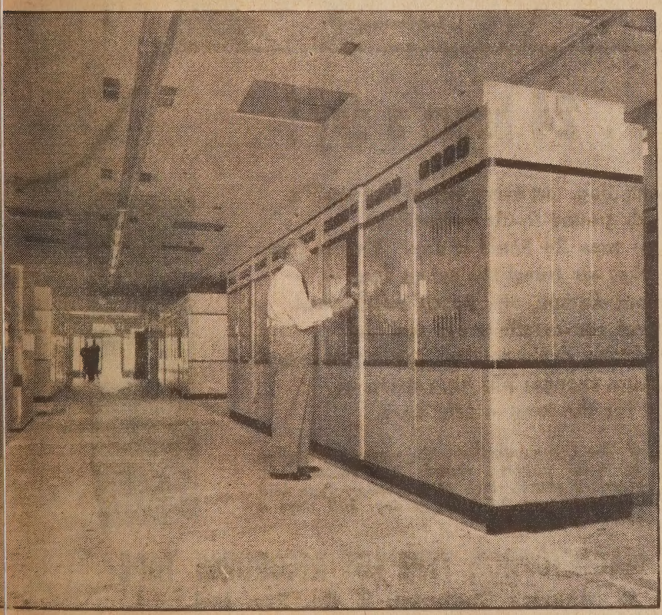
MIGHTY SIGNAL

Its mighty spark signal was known to hundreds of young experimenters as VIS, equally famous with Melbourne's VIM. How many of you hunted for it on your crystal sets, without realising that there were hours when it was not even on the air? It operated on a wavelength of 2000 metres, and, of course, on the ship frequency of 600 metres, long before the era of short waves.

The station was owned by the Government and the initial equipment installed there was made by the German firm of Telefunken.

Soon afterward the Telefunken and Marconi interests in Australia merged and became the firm of Amalgamated Wireless. This firm owned, operated and developed the overseas radio system until the year 1948, when, by international agreement, the system was taken over by a public body, the Overseas Telecommunications Commission.

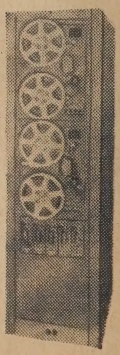
Pennant Hills did not share in the first use of these short waves or high



A splendid picture of the transmitting hall and the new, modern equipment. These two units have an output of 30 Kw Peak Envelope using Independent Side Band transmission giving them multi-channel facilities. Power supplies are on the floor beneath.

eavesdropping . . . 24 hours a day!

It's a full time job, this eavesdropping. At every one of the world's major airports, all air-to-ground, ground-to-air instructions are listened to and recorded on tape 24 hours a day. This is just one of the precautions that makes air travel the safest form of public transport. Throughout Europe, the South Pacific and Australia, these pilot and control conversations are recorded on BASF Magnetophon recording tape. In the services, too, where precision counts, where extreme temperature changes put high strain on tape BASF Magnetophon is by far the most widely used.



● *The Communications Magnecorder installed in major airports, records four channels on standard quarter inch Magnetophon Type LGS recording tape 24 hours a day, 365 days a year.*

BASF

MAGNETOPHON TYPE LGS RECORDING TAPE

● **Maurice Chapman & Co. Pty. Ltd.**

31 Macquarie Place, Sydney. BU6401.

equencies when they were initiated r the London Beam Wireless Services, nese were established in Victoria, ainly because the terrain in that State as more favorable for long wave com- unication, which initially the Beam as to have used.

ECEIVING STATION

When first established, both receiving id transmitting were carried out on e same site, but as time wore on, and affic increased, this became imprac- able.

In 1926, therefore, the receiving ction was moved to the heights of a Perouse, and so was born another our famous radio centres.

The impossibility of erecting a large ray of rhombics on the 40-acre slopes Pennant Hills was a major reason r the move.

Such aerials require wide, flat areas r their long, accurately placed wires. id at Doonside, where there were 740 res of almost ideal land, a start was ade to build up an entirely new instal- ion.

The first services from Doonside were action during the visit of Her Majesty e Queen in 1953, but they were tem- rary only and soon shut down. The g move from Pennant Hills began on ctober 31, 1955, and was completed December 2 of the same year. On ecember 3 the old station was closed.

Doonside is not yet complete but ready it can supply 40 different cuits to various world addresses with nsmitters ranging up to a maximum 30 Kw. It has cost £835,000 to ild, this amount including the com- ete installation, roads, fences and on.

Only £51,000 of old equipment was stalled at Doonside as compared with 352,000 worth of new.

To house the permanent staff, there e available 14 cottages which cost 69,000 to build.

There are 36 rhombic aerials con- cted to an intricate switching system hich allows them to be used to best lvtange according to circuits re- uired and propagation conditions. Some this installation has yet to be com- eted. In addition to the rhombics, ere are various vertical and horizontal rials of simple types for general use. ne rhombics of course are mainly eful to give maximum transmitted wer in point to point service.

YPICAL AERIAL

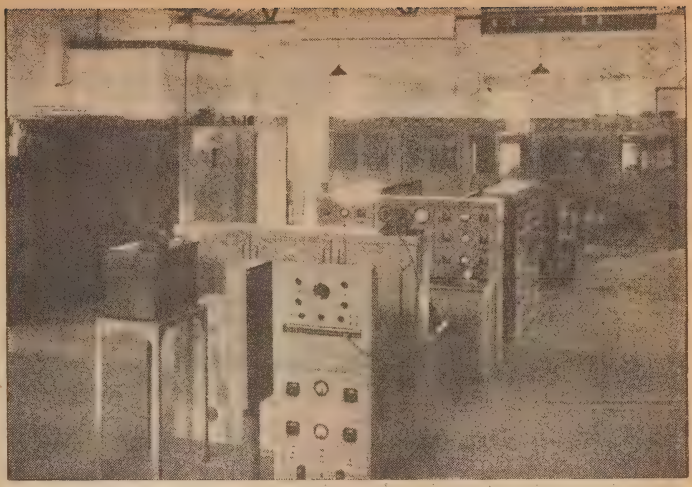
A typical rhombic as used for the ndon service is supported on masts 0ft high, is 960ft long and 330ft de.

The highest mast at Doonside is a 0ft tower, while the big masts at nnant Hills rose to 450ft.

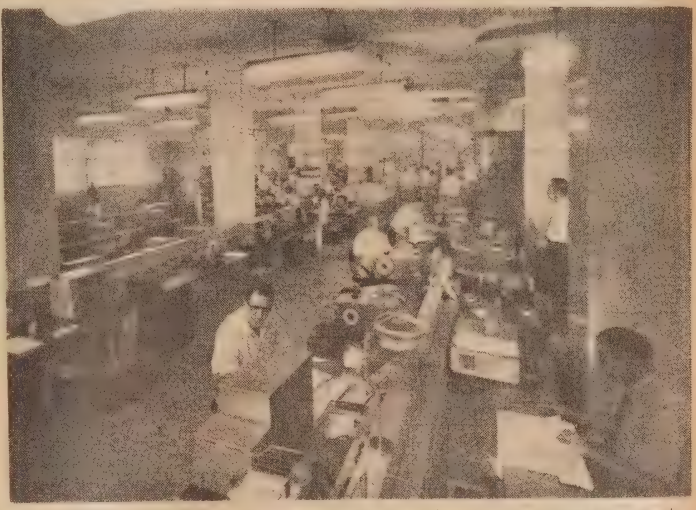
The transmission lines for the ombics are supported on 457 wooden les, and contain 53 miles of hard awn copper conductor with 21 miles iron wire for the rhombic aerial rminations.

The receiving station at La Perouse s also been superseded, a new instal- tion at Bringelly, not far from Doon- de, having taken over most of its cilities.

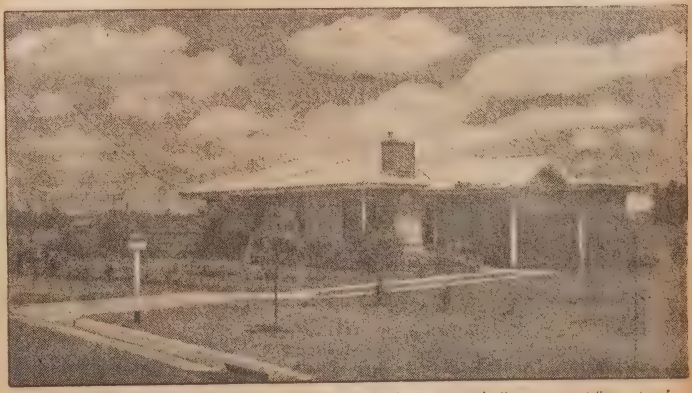
With Doonside it forms a vital part Australia's growing facilities for in- rnational communication.



A picture taken in the old transmitting room at Pennant Hills shows some of the old transmitters which have carried millions of messages to all parts of the world.



From this room at OTC Headquarters n Spring St., Sydney, outgoing messages are sent by landline to Doonside. Machines in this room key the transmitters by remote control.



A typical cottage at Doonside. Fourteen of these were built at a total cost of £69,000 to house members of the staff.

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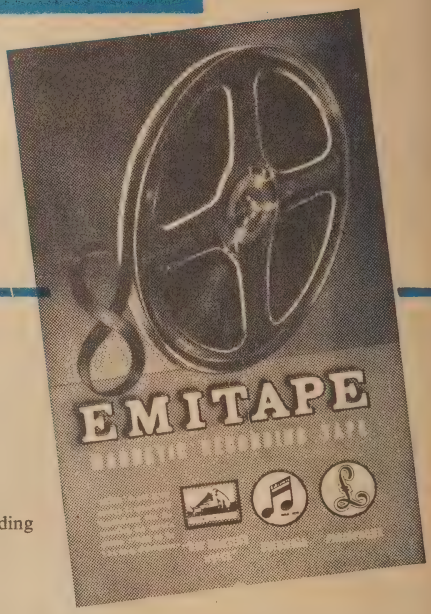

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TR.15.FP

There is nothing new under the sun. Willard Gray holds his replica of a 2,000-year-old wet cell. The Palmyran relief behind him is typical of the era of the world's first electrochemists.

BATTERIES IN 2000 B.C.

We are apt to consider the discovery and uses of electrical current as being of recent times. We find no evidence of electric generators, radio sets and the like in the historical records of old civilizations. But it is almost certain that, more than 2000 years ago, electrical batteries were in use, of a type not unlike the wet cells with which most of us began our experiments when we were very young.

TWENTY years ago articles which could not well have had any other se than as electrical batteries were unirthed in Bagdad by Dr Wilhelm Koeg. of the Iraq Museum. The find was ade at Khujut Rabu'a, not far to the uth-east of Bagdad, and near the railay leading to Kirkuk. The articles emselves were clay jars containing a opper cylinder with an iron rod susended inside it.

These were found among undisturbed lics of the Parthian Kingdom which isted from 250 BC- AD 224. Similar nds were made at Tel'Omar or Seleua, in three of which copper cylinders ill existed. Pieces of copper and iron the vicinity looked suspiciously like e remains of even more cells, indicang that they were originally joined toether.

MODERN REPLICA

Still later, in the Berlin Museum, Dr. oenig found the parts of 10 more cells -copper cylinders, iron rods, asphalt ngs.

Recently Willard F. M. Gray, of the eneral Electric High Voltage Laboraıry, made some exact replicas of these ncient devices, and succeeded in obtainıg electric currents from them.

The cells consisted of a cylinder made of thin sheet copper 9.8cm long and 2.6cm in diameter. The cylinder was joined by soldering, and the mixture, believe it or not, was a 60-40 tin-lead alloy as widely used today.

The bottom of the cylinder was a crimped-in copper disc insulated with a layer of asphaltum. The top was closed with a one-hole asphalt stopper through which projected an iron rod. So that the cell would stand upright it was cemented into a small vase.

Working model of the battery from ancient Bagdad showing the iron electrode, insulated with asphalt, and the copper cylinder, which held an unknown electrolyte. The vase was strictly utilitarian—it provided support.

All that now remained was to fill the copper cylinder with a suitable electrolyte and it was ready for use. The copper-iron combination of these batteries is the same as that used by Luigi Galvani in 1786, when he "discovered" the galvanic cell.

No one knows what electrolyte was used by the Parthians, but Gray's model worked well with copper sulphate. Acetic or citric acid, both of which ancient chemists had in plenty, should be even better.

And the use of the batteries to the Parthians? Almost certainly as a source of current for electroplating metals. The Sumerian and Babylonian predecessors of the Parthians were accomplished chemists and metalurgists.

There is no supporting evidence to show that the users understood the electrical theory behind the process — it is most likely that it was discovered by accident. But such trade secrets were zealously guarded in those times, and it is quite understandable that this one died out as being little more than a useful trick.

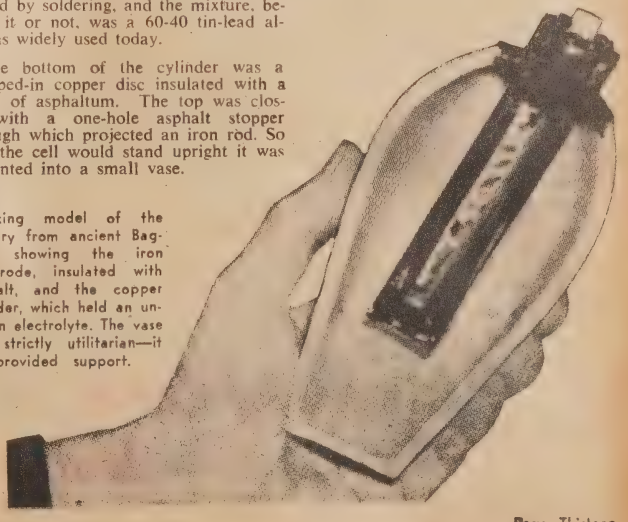
ANCIENT LIFE IN USA

WHAT are perhaps the oldest dated traces of early man in the Americas have been discovered in Denton County, Tex., according to Science magazine.

Charcoal from ancient campfires has been dated by the radiocarbon technique as being more than 37,000 years old. Found with the ancient campfires were remains of Pleistocene animals and a man-made flint spearpoint.

The Texas site includes 14 hearths where meals were cooked and around which hunters lived temporarily. Animal remains found included those of the elephant, bison camel, horse, glyptodon (an ancient mammal related to the armadillo), antelope and bear species.

Other recent finds, reported by the National Geographic Society, were found in a limestone cave on an Alabama farm. Radioactive carbon tests of these finds put their age at approximately 8000 years.



When wifey issues instructions about home decoration, it is just as well to look pleasant. After all, she may be a student of visual psychophysics.

WHEN IS A COLOR JUST RIGHT?

The growing importance of color to our everyday life has given rise to the new science of visual psychophysics. Without perhaps recognising it, we meet the new science on every hand.

by Calvin Walters

THE science of visual psychophysics may be defined as the psychological effect on the individual of phenomena perceived through the sense of sight.

Just how much color enters into our way of life can be judged in many different ways.

The clothes we wear, the food we eat, the petrol or oil we use, the soil we cultivate, the jewels we wear, the houses we build are all, to a very great degree, determined by color.

JUST SAYS "YES"

If you wish to prove this all you need to do is go shopping with your wife when she is buying a dress. How do you like this shell pink, dear? What about the sky blue? Or this American beauty? Isn't this buttercup lovely or this Chartreuse? What about this crushed rose or this twilight blush and so on?

Half the time a mere man doesn't know what she is talking about so he simply agrees, if he is wise. He is mostly concerned with the price which makes it hard to look pleasant.

Have you decided to repaint your house? If you haven't then you are lucky. If you have then you are in for it. I have recently repainted my own and I can assure you that if I have to go through it all again, I am selling out before it happens. I have seven drawers full of color cards. There must be about 700 different paint colors and more are being invented every day.

And the arguments. Whether to have four different colored walls to each room and another one on the ceiling. Will they match the furniture or the carpets or the color of the cocky's cage?

We finished up with a garage full of half-empty paint tins, dozens of empty mineral turps bottles, thinners, plastic paint, gloss paint, flat paint, resin paint, silicone paint and 24 paint brushes which cannot be used again.

Having done all this, my wife decide that the lounge suite needed reupholste ing because it didn't match the colo of the front door. The old kitche furniture was out of keeping with th rest and we need new kitchen cupboard and a stainless steel sink and a pati off the back veranda which, incidentl and in passing, needed glassing in t make a sun room.

HIGHER PAYMENT

The result of all this is that if I ca persuade Radio, Television and Hobbi editor to pay me £10 a word for a my articles for the next 10 years I wi just be able to scrape through th financial crisis.

Yes, Color plays an important pa in our lives!

In any class of manufacturing, th value of many raw materials is judge by the color as is also the finished pr duct. The color variations during th refining of oils and greases are car fully observed and measured. Ra materials for the manufacture of woo len and cotton goods are judged b color. So are bricks and stone an timber for building purposes.

The farmer looks at the color of th soil when judging the value of lan just as the products of the soil a assessed for value by the color.

We choose our motor cars and the u holstery by color; food packed in dra packages do not appeal like colore packages.

We look to the color when cookin food, even going so far as to put l carbonate of soda in with cooking pe and beans, because it makes them green but not one iota more nourishing. F the same reason margarine is color yellow and cordials are artificially col ed to make them closer to the name.

ARTIFICIAL LIGHT

The wider use of color began abo 30 years ago, coincidental with the a vance of higher illumination by ar ficial light.

The replacement of daylight by hig level artificial illumination in hospi operating theatres gave rise to proble of glare from the white walls of t theatre. Studies by eye experts and su geons led to the adoption of softer colo for the walls and ceiling. These we painted in shades of blue and green whi not only had the effect of reducing gla but showed a distinct advantage ov white, in that the soft blue-green shad were complementary to the red blood and human tissue, thus reduci eye strain to the surgeon.

This was the beginning which gave r to experiments in schools and industr Probably the first industry to app

or was the pharmaceutical industry. ainly because it was so closely allied t medicine and therefore the value of c or could be better understood.

In this industry several problems re- ling to the threading of surgical edles, the filling of small bottles and t: mixing of certain medicines were ickly overcome by the proper applica- n of color and illumination.

Today the use of color is widespread l order to gain improved production, duce accident rate, lift morale, more ficiency and better workmanship and

colors for boxes which have to be carried about factories.

The use of color in the control of temperatures is not a complicated matter in that it is simply one where white and light colors reflect or repel heat while black and dark colors absorb heat.

Nevertheless it is interesting to have some figures to give some idea of the effects of various colors on temperature. These figures were given by the United States Bureau of Mines and are

efficiency of the radiator by 17 pc.

The holds of ships painted white are much cooler than those painted black by as much as 10 degrees in the tropics. Protecting helmets used in iron works or worn by motor cyclists or car racers are not painted white for appearance only. On a hot day the difference in temperature inside the crown between a white and black helmet is as much as 22 degrees.

There are at least 10-million colors to which the eye is receptive. You will find this out when you decide to paint your home.

The holds of ships painted white are cooler than those painted black by as much as 10 degrees in the tropics . . .

ality, improved relationship between e public and businessman, reduction of estrain, less fatigue and happier work- s.

The varieties of taste in color is end- ls. What is one man's meat is another an's poison. No one can say just why eryone does not like the same color. olor perception is a very complicated ocess and is influenced by many fac- ts.

It has been found that the presence of rtain sounds influence color percep- n. Low pitched tones will make olors appear darker whilst high-pitched nes will make the colors appear lighter i shade. Thus with a low pitched tone unded at the same time as the obser- vion, red appears more bluish or rply. Green appears bluer and blue comes more violet. High-pitched unds makes red more yellowish, orange re yellow and so on. This was proved i 1931 by Karl Zietz.

SOUND & SIGHT

Further peculiar properties were dis- vered later by Krakov of Russia, Allen nd Schwartz of Canada. They found nt, while a sound was being produced. t: sensibility of the eye to the green ue part of the spectrum was increased ile the sensibility to the yellow-orange ri parts was decreased.

They also found that smell and taste ifluence color perception. Bitter sub- nces placed on the tongue have the ect of reducing the sensibility to red ad increasing the sensibility to green.

The same effect is apparent when the cour of oil of geranium is present.

The researches of another expert, Kurt Goldstein produced the surprising result tit red light is prone to make the server overestimate time whilst green c blue light has the reverse effect.

This knowledge has led to the adop tn of "cool" blue green colors in ices and factories where some nonotonous tasks are being carried out. Conversely in lounge-rooms, restaur- nts and so forth warm colours are tter.

Estimation of length is influenced l colour. Under red light objects ppear longer and larger while green c blue light makes them appear shorter nd smaller.

Similarly in the estimation of weights bjects will appear heavier under red ht and lighter under green or blue. Tis has led to the adoption of light

based on the effects on evaporation in a 12,000-gallon petrol storage tank, over a period of 4½ months.

A tank painted white lost 112 gallons by evaporation. One covered with aluminium foil lost 170 gallons. A tank painted merely with aluminium paint lost 187 gallons while a red tank lost 284 gallons. A black tank would have lost still more but there are no figures for this.

EFFECT OF COLOR

These figures bring to prominence at least one important aspect. The use of aluminium paint on steam heat radiators is not as good as once was thought. Metallic paints reduce the transfer of heat. In fact the United States Bureau of Standards conducted some experiments and showed that the use of metallic paints reduced the

COLOR PREFERENCE

Every one of these colors has an effect on the person who looks at them and they affect people in many different ways.

One of America's leading color experts Faber Birren points out that the human race tends to fall into two color preference groups. There are those who prefer warm tones and those who prefer cool tones.

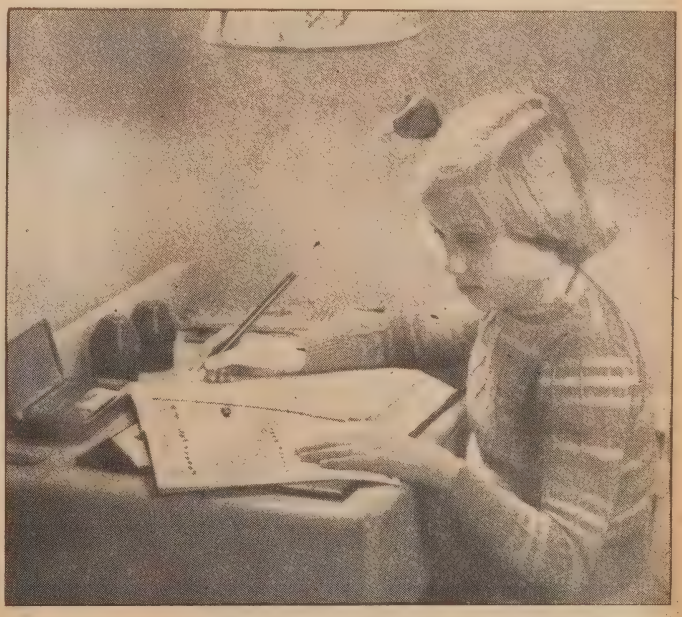
This preference is reflected in the character of the individual.

Those who prefer warm tones are usually receptive to outside influences, readily fit into the social structure in which they live, have a warm nature with a rapid mentality.

The cool color subjects are usually detached, cold and reserved and find difficulty in adapting themselves to changed circumstances. They cannot always express themselves clearly.

I know this all sounds like a fortune teller's fairy tale but the above findings are the results of efforts by experts.

It can easily be seen why conflicts of opinion result between a number of



Color is important to children in their studies both at home and at school. Light colors like white and pale yellow are better than reds, which produce restlessness.

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UPRIGHT OR FLAT THERE'S A TYPE FOR EVERY APPLICATIO

ividuals when planning color emes. Unanimity rarely emerges n such discussions, the results being ally somewhat of compromise.

The choice of colors for specific purs must be well thought out if the ired effects are to be obtained on individual who must live or work the environment.

Colors in the field of red stimulate body to increased tension. This or therefore would not be used in pital wards or some factories where quillity must prevail. The color to used in such places would be cool ors such as greens or blues which ase tension and have a lesser im- t physiologically.

t has been found, according to ren, that jovial people prefer orange s, artistic people as a rule prefer ple.

OLOR IN SCHOOLS

n schools it is necessary to have ghtness. Thus the most useful colors corridors are ivory and pale yellow gesting sunshine, white ceilings to ect the maximum amount of light, e blue, green or peach for walls. Is are too exciting and tend to make child too anxious for playtime and less.

He may even be tempted to throw ngs about and get up to other mis- lf.

According to Birren the wall around black board should have correct atment and should be painted in dium tones instead of light ones so to reduce contrast.

As to the blackboard itself it has n found that the best "blackboard" a light green one with yellow chalk.

Regarding the legibility of colors this ies according to circumstances.

For light signals the most easily ognised is red, with green, yellow l white following in that order. If material is opaque and viewed under al lighting conditions yellow is most ble while orange holds the attention ger.

Blue is not good and may be indis- ct.

The best color combination is black yellow followed by green on white, on white, white on blue, black on ite with any combinations of red l green or red and blue a very bad .

ANDARD COLOR CODE

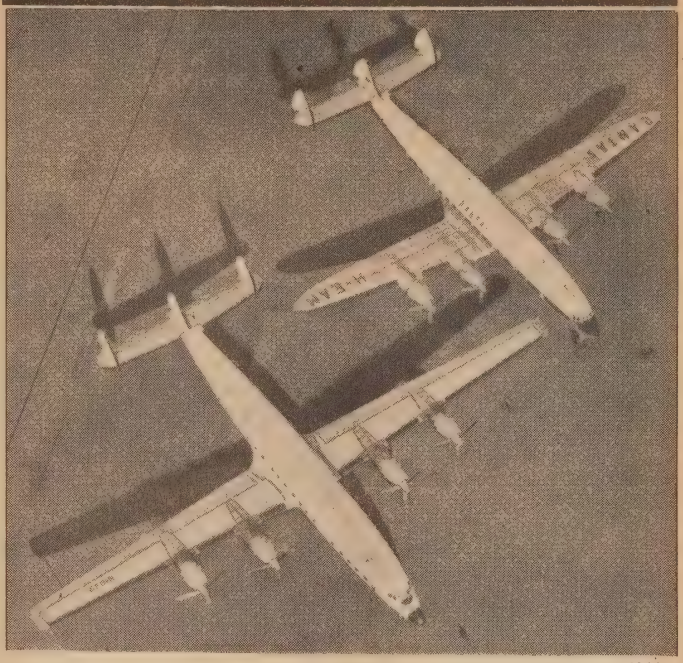
n order to standardise on color com- ations as indicators in factories and er places where people work, a or code was worked out by Faber ren of America and is now prac- lly in universal use through the rld.

This code makes use of squares, tri- gles, circles, crosses and so on. ored in conformity with the psycho- ical effects which certain colors have the individual.

Where there are low beams, dead ls, edges of pits and platforms, these marked with alternate yellow and ck stripes or indicated by a square h yellow and black stripes.

First aid chests, stretchers, medicines l so on are marked with a green ss.

THEY DON'T COME MUCH BIGGER



A striking picture comparing the latest Lockheed commercial airliner—the 1694A Super Constellation and the 1049H convertible passenger-cargo Super Constellation. The 1649A is the longest ranged aircraft in the world, capable of non-stop flights of 6300 miles without consuming reserves. Its wing has a 150 ft span, and carries 9600 gallons of fuel. Aspect ratio is 12, and cruising speed is 350 mph.

Red is used for no other purpose than to mark fire fighting equipment and on valves and hose connections. It is indicated by a red square where it is not possible to paint the equipment itself.

A blue circle indicates caution. It is placed on lifts, machines, and ovens which have been put down for repair and on switch control boxes to remind the operator to clear his machine before he switches on the power.

An orange triangle symbolises that there is a first-rate hazard present. This may be anything which may burn, cut, crush or shock the worker, as for instance, around the edges of cutting machines or rollers. If this color is painted on the inside of machine guards when in the open position it gives an unmistakable signal that danger lurks.

This system of color signals has been responsible for the saving of many lives and limbs. Even in factories and workrooms with inadequate lighting such color symbols are clearly visible.

An interesting sidelight is the effect of color on birds and insects.

BIRDS SENSITIVE TO COLOR

Birds are very sensitive to color and will often take food more readily from a red food box. When laying poisoned seeds to kill rats and mice it is better to dye them green. The birds will then rarely touch them because they appear unripe while the rat, being color blind, doesn't know the difference.

Low power red or orange light is less attractive to insects. Mosquitoes are attracted by blue and grey tones and repelled by pink and yellow tones.

This short discussion thus indicates that color is a most important factor in our lives. The subject is too vast to touch on anything but the fringes of the science. Those of my readers who wish to go further into the matter are well advised to study New Horizons in Color by the well-known American colorist Faber Birren to whom I am indebted for much of the material in this article.

FULL-COURSE meals in vending machines are beginning to replace cafeterias in some factories, a health authority said recently.

Harold Wainess, a Chicago sanitation consultant, explained that cafeterias are operated in many companies at a loss.

"Some are trying the vending idea. Machines will provide a meal of meat, potatoes and a vegetable at about 75 cents," he said.

The meal is either precooked and kept hot in the machines or is stacked there in a frozen state and cooked electronically.

Wainess said one company is considering installing them in suburban stations so homeward bound commuters can pick them up in time for dinner.

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"LEAK" 12in Arm	£6	8	3
"LEAK" 78 or LP Heads	£13	8	1
"LEAK" Transformer	£4	2	0
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16in Arm Model RK309	£24	7	11
16in Arm Model RF309	£34	2	3
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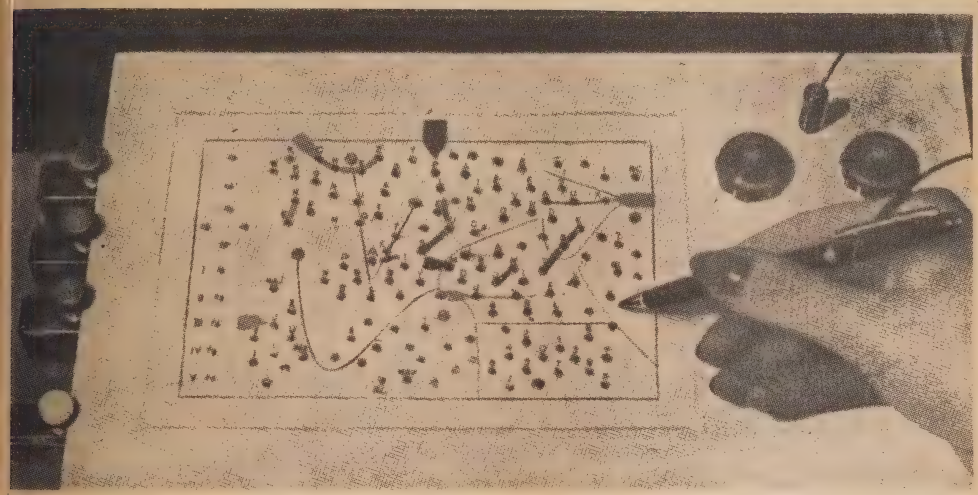
Technical Review



ELECTRONIC STENOGRAPHY

The Electrostyl Keyboard has no keys. A number of points representing letters and combinations is touched with a stylus, and the result can be registered directly on an electronic typewriter.

lectronic gadgets have simplified many aspects of the stenographer's fe by providing new and improved dictating machines, but little ad- ance has been made upon Isaac Pitman when it comes to "taking it own". This French invention however has the elements of a new and interesting approach.

☆

E necessity for improved efficiency in business offices has led to the use of dictating machines, eliminating the ographer. All the secretary has to do is listen to the ated record, usually sentence by sentence, and type the

This part of the job has been somewhat improved by use of so-called noiseless machines and by the electric writer. However, much progress remains to be done in direction, and a new machine which combines stenography instantaneous and automatic typewriting provides an resting and unique solution to the problem.

The Electrostyl, a recent French invention by A. Duc- , is an electronically controlled typewriting machine in h the conventional keyboard has been replaced by a flat el. The operator does not use keys, but a single conduct- probe drawn, pencil-fashion, from point to point on the el.

Each of a number of positions on this panel corresponds letter or a sign, and the letters have been disposed in a way that the more common syllables or words can be e with very simple movements of the pencil probe.

The most frequently used letters have been assigned ral positions. Several improvements are added to this c scheme, such as memory to store frequent complete ences, available at one touch only.

The Electrostyl can be divided in three parts: the keyboard and its probe, the electronic equipment and the electric typewriter.

There is no doubt that, in the future, a special typewriter will be devised to utilise fully the possibilities of the Electrostyl. For the time being, an IBM electric has been put to good use.

The entire machine is used in the usual way except for its keyboard, which is actually hidden under a metallic cover.

What, then, actuates the keys?

This is the role of the electronic system. Each key carries a steel wire, securely anchored at the other end to the moving armature of a relay. For the present experimental models, such an arrangement is quite practical.

THE ELECTRONIC EQUIPMENT

The electronic equipment is housed in the small metallic desk supporting the typewriter. When the operator, with her pencil probe, touches even lightly and for a short time a contact on the letter board, the thyratron corresponding to this particular contact fires and energises a relay which pulls down the correct key of the typewriter.

The accompanying diagram shows a possible way of wiring the circuit. The thyratron is normally cut off by the bias applied to its grid; when the probe touches the contact, the

The WARBURTON FRANKI Page

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313	Super Fan	£11/6/9
330	Rainbow	£21/-/-
607/9	5 Element High Band Yagi	£10/-/-
1007/9	10 Element High Band Yagi	£16/9/-
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1022	10 Element Low Band Yagi	£27/19/6
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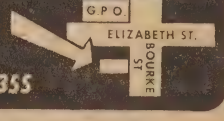

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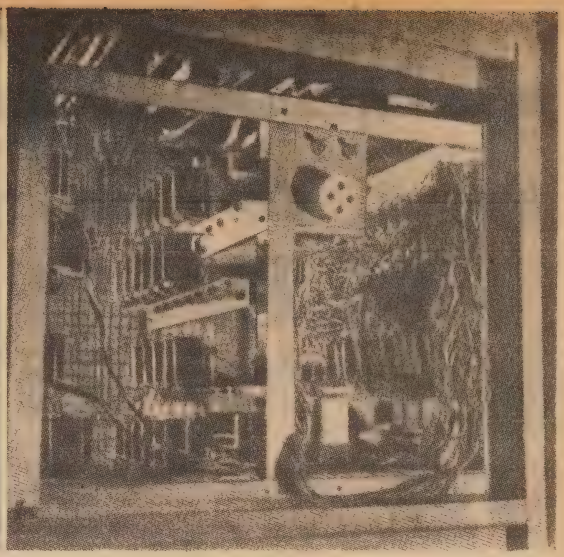


The typewriter Keys are operated by banks of relays seen here at the left of the picture.

jid is shorted to ground and the thyra- on fires. Its plate current energises e relay, whose moving armature pulls own the typewriter key. Simultane- sly, the relay actuates a contact to cut f the thyratron, plate voltage and re- it the circuit.

Needless to say, this explanatory dia- am is much simpler than the circuit tually used in the Electrostyl.

The electronic part is not an unduly mplicated piece of equipment. It nsists mainly of 57 tubes, 45 coils d relays, 10 special relays, and as- rted other components. The wiring, owever, uses 50 miles of wire.

HE KEYBOARD

The keyboard departs radically from ie conventional system. It consists of flat insulating sheet into which are nbedded over a hundred metallic con- cts. The probe itself looks exactly ke a ballpoint pen.

The main work was to design the oard so that the distribution of let- rs led to the utmost speed and effi- ency. This was accomplished with the elp of a specialist in deciphering, who onducted an exhaustive statistical an- ysis of the language. French in this ase.

The most frequent letters, such as , S, A, R, are repeated and placed various strategic points.

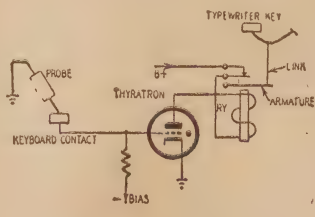
Other letters have been so disposed s to provide very simple "stenogra- hic" moves for frequent groups of let- rs, such as et, de, en, etc., and finals, ch as tion, elle, ette.

New boards will, of course, have to e designed for other languages. The lectrostyl, however, will be universal, nce any board can be used and can e plugged in through a multiplug con- ector.

Two special contacts are used to hift to capital letters. One is a "one- tter" contact, shifting to capital only or the next letter. The other is a "permanent capital" useful for a series of capital letters.

These two contacts correspond more or less to the capital shift and the shift lock of the typewriter. An intri- cate system of time delays and inter- locking relays is necessary for its satis- factory working.

For numbers or signs correspond- ing to a shift to capital no special ad



Simplified design of Electrostyl

ditional contact is necessary, the shift being automatic.

A set of pushbuttons puts the usual controls of the IBM electric machine under the hand of the operator.

An electronic memory is an integral part of the Electrostyl: it may store up to 16 sentences of 50 letters or signs each, and could be enlarged if necessary. Any of the stored sentences —for example the beginnings or ends of letters—is available at a single touch of a contact. (An obvious extension of the storage facility would be to write identical circulars, each one being really an original.)

Another possibility is to store sen- tences "written" on the keyboard until typing is ordered, thus allowing cor- rections or modifications before typing. The memory unit is simply made of 16 50-position, telephone step relays.

Of course, since electric circuits play the role of an intermediary between the keyboard and the typewriter, the two can be placed any distance apart. This opens up completely new pros- pects.

An immediate idea is to have the typewriter in a separate room and do away with the noise. Automatic sys- tems can feed the paper and collect it once typed.

Numerous other features can be add- ed to the basic machine just described. Undoubtedly, use will bring important improvements.

THE FUTURE

Besides the immediate typing of the dictated letter, the Electrostyl offers several important advantages. It is very easy to memorise the moves cor- responding to syllables, and the special stenography can be learned in a short while by the average operator. It is much less tiring to shift the probe than to work a conventional keyboard.

An improvement in this direction has already been suggested: it consists of grooves in the keyboard corresponding to the usual syllables and guiding the probe.

Other possibilities are the use of such machines for typographic com- position and remote printing.—Radio Electronics.

Navigational Aid

IT was recently revealed that for the past two years Marconi's have been in quantity production with an Airborne "Doppler" Navigator, for use in the most modern aircraft.

Known as Type AD.2000, it is en- tirely independent of ground station facilities. Used with the aircraft's gyro- compass and a suitable computer, it can provide an automatic and con- tinuous flow of navigational information such as immediate position in latitude and longitude, track guidance, distance run or distance to go, estimated time of arrival, and wind velocity

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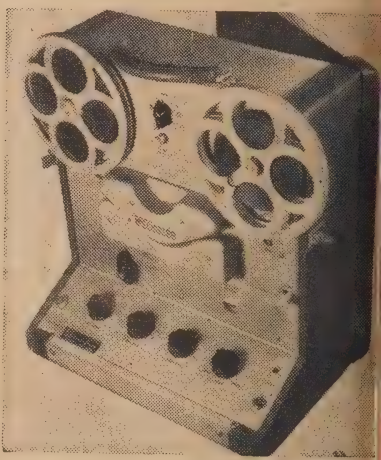

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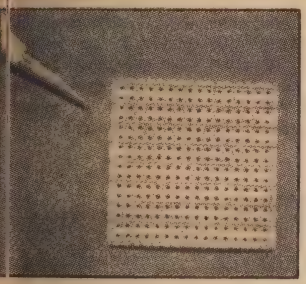
MINIATURE MEMORY FOR COMPUTERS

The electronic memory, a key element in modern commercial and military computers, has been reduced to unprecedented compactness and simplicity by RCA Laboratories with the development of a novel printed plate magnetic storage unit that can tuck away 256 bits of computer information in a thin wafer less than an inch square.

NKED in series to form a large-capacity memory system, the tiny es will enable computers to store tronically more than a million bits nformation in a space about the size shoebox, and to recall the bits in a millionths of a second in any desired r, combination, or quantity.

he fruit of a continuing research gram that led to the earlier develop-t of the magnetic core memory used many present-day computers, the new erture plate" memory was devised a research group under the direction Dr. Jan A. Rajchman, research scien-at RCA's David Sarnoff Research tre.

n appearance, the tiny plate is some-g entirely new in electronics. Per-ted with neat rows of minute holes, esembles a diminutive punch-board. Dr. Rajchman points out that the new nory, unlike the earlier magnetic



his tiny perforated plate is the heart f the new memory system. Compare s size with the tip of the pencil at the top left.

e system, lends itself to extremely ple production techniques.

he tiny plates are made of an ferro-gnetic material, a ceramic-like sub-nce that can be moulded in any de-d shape or size and hardened by ting.

hey are produced with essential cir-fact that computer language can be ressed entirely in terms of "0" and ", used in various combinations to resent any words, numbers or sym-s.

As an example, one such coding sys-try already incorporated by means of printing technique similar to that used making printed electronic circuits for dio and television sets.

The fabrication technique, developed b Chandler Wentworth of the RCA boratories technical staff, has been d to produce thousands of the plates ing the research program.

Dr. Rajchman explains that the aper-e plate memory, like its magnetic core decessor, depends for its operation on n expresses 0 as OOOO, the number as 0001, 2 as 0010, 3 as 0011, 4 as 0100, and so on up to 9, which would be expressed as 1001.

"When we translate into a language that employs only two symbols, it is possible to design a memory system in which each of the elements can be switched electrically to represent one or the other of the two values," says Dr. Rajchman.

"In the aperture plate, one of the values is represented by a flow of magnetism, or magnetic flux, in one direction around the hole in the plate while the other value is represented by a magnetic flux in the opposite direction.

"The values can be changed as desired simply by applying to the right spot an electrical signal strong enough to reverse the direction of the magnetic flux."

The circuits of the memory are so arranged that each of the holes in each plate can be reached individually for putting in or reading out information.

Looking ahead to the application of the new aperture plate system and the further development of magnetic memories, Dr. Rajchman says:

"The development of these plates has now reached a stage which opens possibilities of memories of very large capacities. Because this arrangement requires much less driving power than previous systems, it promises also to reduce and simplify the associated electronic circuits.

"Furthermore, it makes possible very compact memories of relatively small capacity.

"Three years ago, it was predicted that micro-second memories with capacities reckoned in millions of bits would be available at a relatively low cost in a distant future. We believe that the aperture plate is now ready to usher in this era.

"But the demand for larger and faster memories is incessant, and we may look forward to the development of still newer techniques in the future, making possible the storage and instant selective readout of billions of bits."

Dr. Jan. A. Rajchman, of the David Sarnoff Research Centre, who devised the new memory plate.

NEW LONG-LIFE TV RECTIFIER

THE first line of germanium rectifiers specifically designed for TV power supplies is being incorporated in new TV receivers just reaching the US market. The new semi-conductor units are being produced in quantity, at prices competitive with selenium rectifiers by the General Electric Company.

Equally as important as the news that these units are being incorporated in original equipment is this follow-up announcement: these germanium power diodes are also being made available through parts jobbers in a form that will permit use as replacements for the more conventional selenium diodes found in counteless receivers already in use.

There is nothing new in using germanium as the element in a crystal rectifier. Historically, this material antedates selenium in such a role. Also, it has been known to enjoy certain advantages over selenium.

However, until recently developed production techniques cut back the cost of manufacture sharply, germanium rectifiers could not be made available at the voltage and current ratings required for use in TV and radio power applications except at prohibitive prices. These new units are competitively priced.

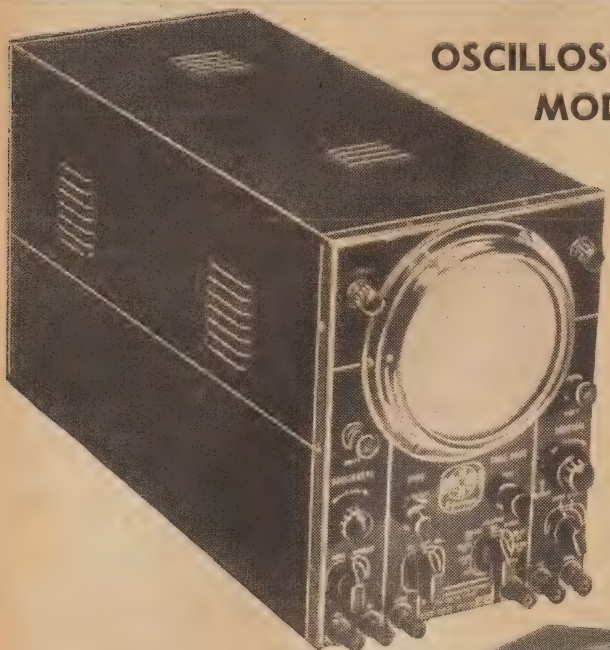
The first three rectifiers to appear in the line are RETMA types 1N573, 1N575, and 1N581. The first is a half-wave unit that delivers 250 mA. of DC output. The 1N575, also a half-wave rectifier, is designed for 350-mA. output. The 1N581, consisting of two rectifiers already connected in a voltage-doubler configuration, is rated at 250 mA.

Full-cycle average full-loan voltage drop for these devices is very low: a maximum of .15 volt for the 1N573 or the 1N581, and a maximum of .3 volt for the 1N575. Maximum peak inverse voltage ratings of 380 volts apply to all three. Also, each of them is designed to be used with a 4-ohm surge-limiting resistor. The units are hermetically sealed in metal cases and are warranted by General Electric for one year.

Physically, the units are smaller and lighter than their selenium counterparts and, even at the small size of the entire unit most of it consists of a radiating surface or heat sink and a mounting bracket.

The actual germanium element is much smaller than a dime. On the rectifiers being shipped to set manufacturers, the mounting bracket is a mechanical snap-in type to keep chassis assembly costs down and also to streamline later replacement. The types being produced for field replacement of selenium rectifiers are electrically identical to these, but have brackets that will permit direct mounting, where conventional selenium devices were used, without any physical alteration.

UNIVERSITY TELEVISION TEST INSTRUMENTS

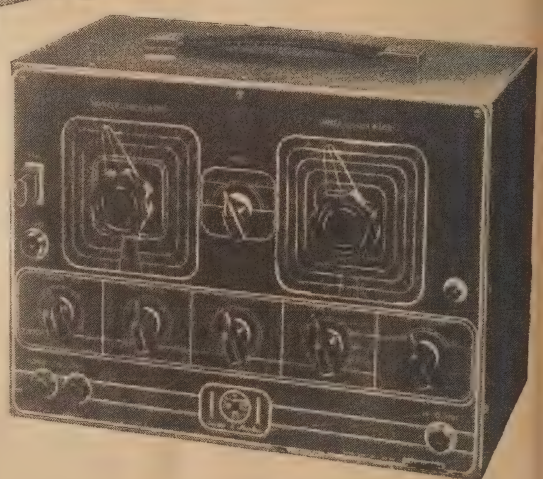


OSCILLOSCOPE 5in. MODEL TVR/C5

This 5in Oscilloscope has been developed for TV and radio-servicing and for general purpose use at frequencies from 10 cycles per second to 5 megacycles per second. The frequency response of the vertical amplifiers in the normal position is 10 cycles to 1 megacycle, plus or minus 1db. In the wide band position the frequency response is from 5 cycles per second to 3 megacycles per second, plus or minus 1db. The sensitivity in this position at 6 megacycles is minus 3 db. Horizontal amplifiers have a frequency response at full gain from 20 cycles to 1 megacycle plus or minus 2½db. The time base generator has a frequency range from 15 cycles per second to 250 kilocycles in seven coarse steps with a fine control.

MODEL TVR/SM

The Model SM, combined sweep and marker generator, has been especially developed to simplify the exacting task of aligning the tuned circuits of TV receivers.
Used in conjunction with the University C3 or C5 or similar oscilloscope the actual shape of intermediate frequency and overall selectivity curves is made clearly visible.
The Model SM provides an RF signal which is made to sweep several megacycles either side of the centre frequency selected by the tuning dial and range switch.
Tuning range (1) covers sound IF bands including 5.5 and 10.7 mc/sec.
Range (2) covers all TV intermediate frequencies including Australian standard and non standard IF's.
Range (3) covers low band channels 1 to 3.
Range (4) covers high band channels 4 to 10.
All tuning ranges are on fundamentals to avoid spurious signals or beats.
A crystal controlled 5.5 mc/sec oscillator is also included to provide two simultaneous marker indications and to provide a means for accurately checking the tunable marker.



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NEWS AND VIEWS OF THE MONTH

oms for Britain

GIGANTIC new atom power scheme has been announced for ain under which the nation will spend million sterling by 1965.

he Minister for Power (Lord Mills) ounced plans to build 19 atomic er stations, with the aim of trebling output of "atom" electricity.

y the end of this year Britain will be sting in the atom at the rate of £3 ion sterling a week.

When the vast programme is fully er way 75,000 men will be employed ding a ring of atomic-power stations coastal estuaries.

ace travel decried

NTERPRISING scientists who were planning journeys to the moon uld not have been encouraged by a imistic forecast during the month.

Dr. Lee de Forest, one of America's st famous scientists, dismissed as im- sible one of modern science's per- ent dreams—travel into outer space.

Dr. de Forest known as the Father of Electronics, predicted that man will never reach the moon, let alone el by rocketship to strange worlds instant galaxies.

He said that only his scientific imagin- on will ever make man a planetary rant.

Dr. de Forest invented the vacuum e that made possible the development modern radio broadcasting, television and radar.

Dr. de Forest forecast transoceanic television within 10 years.

He said this could be accomplished by skilful location of relay stations and by taking advantage of reflections of television waves from the ionosphere—the layer of electrical energy which surrounds the earth at a great height.

British TV in trains

BRITISH railways will put into service in April the first train permanently equipped with TV.

Programs from a special sound-proof coach on the train will consist of light entertainment and interviews with occasional views and comments on the passing scenery.

Recorded programs and films will probably be possible later.

The first TV train will be an excursion for soccer fans on April 5, from Glasgow to London for the England v. Scotland Association football match at Wembley.

No more battleships

SEVERAL controversial defence matters seem to have been resolved in recent months.

Some weeks ago the RAF was reported to have decided upon the last type of fighter plane it would take into service.

Defence chiefs consider that guided missiles have rendered fighters obsolete; that Britain's future menace will not come from manned bomber aircraft as in the last war.

It seems that the Royal Navy will never use battleships again in battle.

The First Lord of the Admiralty, the Earl of Selkirk, said this at Plymouth recently in a tour of naval establishments.

He said the navy had not yet decided what to do with the battleships it had no more use for.

If possible, they would be sold to friendly countries.

Lord Selkirk said aircraft-carriers were the navy's modern capital ships.

POPULAR SCIENCE QUIZ

Q: When a radiator is plugged into a power point and operated for a time, the plug and wall socket often become perceptibly warm to the touch. What causes this rise in temperature?

A: Such a rise in temperature would most likely be due to the fact that there is poor or insufficient contact between the plug and the socket blades. This becomes evident as a resistance across which the current produces a loss in voltage.

The heating effect in watts can be calculated by multiplying the current flowing through the circuit by the voltage drop between the contact blades.

The presence of resistance and a high-load current can likewise produce heat if the connections between cable or flex and the plug or socket are not tight. Even the flex itself may become slightly warm if it is too light to carry the load current passing through it.

Q: You've probably read about the rocket sleds which are used by Lockheed to investigate various supersonic aircraft phenomena. How fast can such a sled travel?

A: The speed is adjusted to any desired figure by varying the number and type of propulsion rockets. Recently, however, a rocket unit set a world's record at Edwards Airforce base in California. It reached a sp ed of 1560 mph on a 10,000ft track.

A pusher sled carrying five rockets accelerated the unit to 620 mph over the first 950ft of track. Then seven rockets on the main sled took over and ran it up to the record speed mentioned.

Near the end of its run, it was stopped by water brakes.

Q: Speaking of land speeds, what progress has been made in this direction with gas turbine cars?

A: Many of the world's leading auto manufacturers are experimenting with gas turbine cars but not saying very much, for rather obvious reasons.

However, it has recently been revealed that an experimental Renault, powered by a 260 hp gas turbine, can top 200 mph with its motor turning at 28,000 rpm.

Strictly an experimental car, it has been christened "Flashing Star". It is built like a racing car and is extremely light.

Q: What conclusion would you draw if you were to see an Army Survey unit running round in jeeps carrying radar equipment?

A: One might assume that the jeeps were merely borrowed from another unit for personal transport but there could be a much more official and practical explanation.

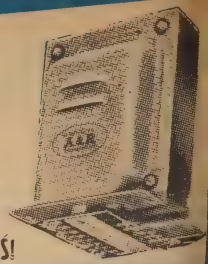
For some purposes, optical survey methods are too slow because the distance between reference points is small.

Using a couple of jeeps with radar-like equipment, distances of up to 50 miles can be stepped off in a single operation. The jeeps are set up at the points in question and pulse signals bounced back and forth between them. The pulses are counted and compared with elapsed time by a computer, which then gives the distance between units. It is claimed that the readings can be accurate to within a few feet over 50 miles.

ELECTRONIC

A&R Transformers

EQUIPMENT



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A NEW DEVELOPMENT!

TYPE 2525 OUTPUT TRANSFORMER GIVES TOP-CLASS PERFORMANCE IN MULLARD "5-10" AMPLIFIERS!

Read these extracts from the recent report from the Technical Services Department of Mullard (Aust.) Pty. Ltd., dated January 22, 1957.

We have pleasure in advising that we have now had an opportunity of testing this component at some length and find its performance in the amplifier (5-10) satisfactory in all respects. The most marked improvement (over Type 2505) is in the matter of rise time — a direct result of an increase this componen tis now in top class. and we have no hesitation in recommending this transformer to our in the transformer self-resonant frequency to approximately 160 Kc/s. The over-all performance of home constructor correspondents

TYPE 2525. /8 for 2 or 8 ohms. /15 for 3, 7 or 15 ohms.

FREQUENCY RESPONSE	+ — 1 DB 10/100,000 cps.
POWER RATING	12 Watts at 30 cps.
PRIMARY IMPEDANCE	8000 or 6000 ohms.
PRIMARY TOTAL RESISTANCE	275 ohms.
PRIMARY INDUCTANCE	50 Hy. (at 5V 50 cps).
PRIM-SEC. LEAKAGE INDUCTANCE	6/10 mH. Depends on P & S impedance.
SELF RESONANCE FREQUENCY	160 Kc/s approximately.
DISTRIBUTED SELF CAPACITY	175 pF approximately
MOUNTING TYPE	C9P.

TYPE 931-15: 20 watts
Prim: 4500 ohms P.P.
Sec.: 3.7 or 15 ohms
Resp.: 10-60,000 cps.
Valves: EL37, KT66 6L6, etc.
19% Screen Taps.

TYPE 931-8: 20 watts
Prim.: as 931-15.
Sec.: 2 or 8 ohms
Resp.: As 931-15
Valves: as 931-15
19% Screen Taps

TYPE 921-15: 20 watts
Prim.: 6600 ohms P.P
Sec.: 3.7 or 15 ohms
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc
19% Screen Taps.

TYPE 921-8: 20 watts
Prim.: As for 921-15
Sec.: 2 or 8 ohms
Resp. As 921-15
Valves: As for 921-15
19% Screen Taps.

TYPE 916-15: 12 watts
Prim.: 8500 ohms P.P
Sec.: 3.7 or 15 ohms
Resp.: 10-50,000 cps.
Valves: 6BW6. 6V6. KT61, etc.
19% Screen Taps.

TYPE 916-8: 12 watts
Prim.: As 916-15
Sec.: 2 or 8 ohms
Resp.: As for 916-15
Valves: As for 916-15
19% Screen Taps

TYPE 949: 12 watts
Prim.: 8000 ohms P.P.
Sec.: 2, 8, 12.5 and 15 ohms
Resp.: 10-50,000 cps
Valves: 6V6, 6BW6. KT61, EL84, etc
19% Screen Taps

FOR MULLARD "5-10" AMPLIFIER

Type 2525—12 watts
Prim: 8000 or 6000 ohms CT.
Sec.: As above.
Response: + — 1 DB 10-100,000 cps

SPECIAL HI-FIDELITY +—½db 20-40,000 Cps

OUTPUT TYPE

TYPE 870 — 6 watts
Prim.: 10,000 ohms P.P
Sec.: 2 or 8 ohms
(for "Rola" 120X)

TYPE 871 — 12 watts
Prim.: 10,000 ohms P.P
Sec.: 2 or 8 ohms

TYPE 872 — 12 watts
Prim.: 10,000 ohms P P
Sec.: 3.7 or 15 ohms

HI-FIDELITY +—1db 30-15,000 Cps

OUTPUT TYPE

TYPE 763 — 15 watts
Prim.: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms

TYPE 920 — 15 watts
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms

TYPE 897 — 15 watts
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms

TYPE 896 — 15 watts
Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms

T.V. KIT

(Designed for use in T.V. Circuit Published by Philips Elect. Ind. P/L.)
P.T. 1790: P: 200, 230, 240V: S: 230-CT-230, 350 mA; F: 2 x 6.3V at 6A.
O.T. 2507: To Philips Specification
Z 1090: 3 Hys-300 mA Choke D.C. Res. 50 ohms

MATCHED KIT (For Mullard 20W EL34 Amp.)

P T 1783 P: 200-230-240v., 50cps.
S: 410-CT-410v., 180 mA
F: 5v-3a; 6.3v-CT-4A; 6.3v-CT-2.5A (Electrostatic Screen)
Z 1092 10 Hys-180 mA Choke; D.C. Res., 200 ohms.
O.T 921 See above Tested and approved for use in this Amp., by Technical Service Dept., of Mullard (Aust.) Pty. Ltd.

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he recent Suez campaign had proved
r worth.
hus Britain has given the answer to
question which has caused much
erence in naval circles since the
ing phases of the last war.

ritain's Sensational Arms

the light of our various paragraphs
and comment about Britain's sweep-
changes in air and naval forces, it
interesting to note important state-
nts made during the month at the
ATO Conference held in Canberra.
These concerned tactical atomic
apons stated to be far in advance of
se possessed by any other nation.
One newspaper reported the words
a British delegate that when the
ericans saw the details they were
ivering at the mouth."
No doubt this means they were en-
us.
According to reports, Britain is about
start mass production of these
apons, which will later be available
use in other parts of the world.
laya and Australia will become
mic arsenals.
Britain must be completely confident
out the efficiency of weapons which
l allow her to completely rebuild her
dences around them.
The word "sensational" would be an
derstatement for them.
For if they are as good as they must
it is only a matter of time before
see the military methods of other
ions undergoing similar drastic
anges.
Military might may quickly depend
on the number of soldiers one can
ister, but entirely on the number and
ift employment of weapons.

TV's five-year blackout

Does the introduction of TV into
home inhibit the outside interests of
family?
According to the BBC's audience-re-
arch department, it does.
In the early years of set ownership
loss of outside interest and initiative
substantial, it is declared. Then a
riod of recovery sets in, which is
rarly complete after a period of five
ars.
The study in England embraced 3000
-owning families.

luminium suits for refighters

N engineer wearing a heat-protec-
tive suit, has walked into an in-
strial furnace heated to 1200 degrees
hrenheit. He carried an armload
wood that promptly burst into flames
d burned as he stood in the heat.
in thick steak he held on another
p into the furnace cooked medium-
re in less than two minutes.
The engineer was demonstrating a
w aluminium-coated suit which lets
rkmen and engineers move freely
hot areas. Protective clothing like
is can be used by steel workers, fire-
hters and others.
The engineer stayed in the furnace
r three minutes during one of his
monstrations.

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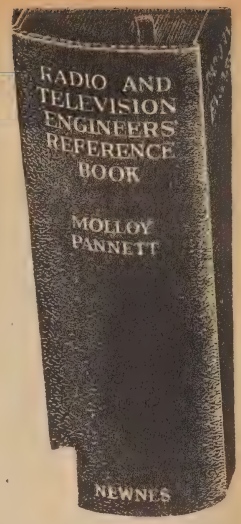

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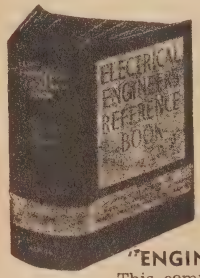

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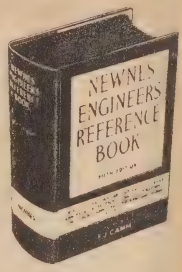

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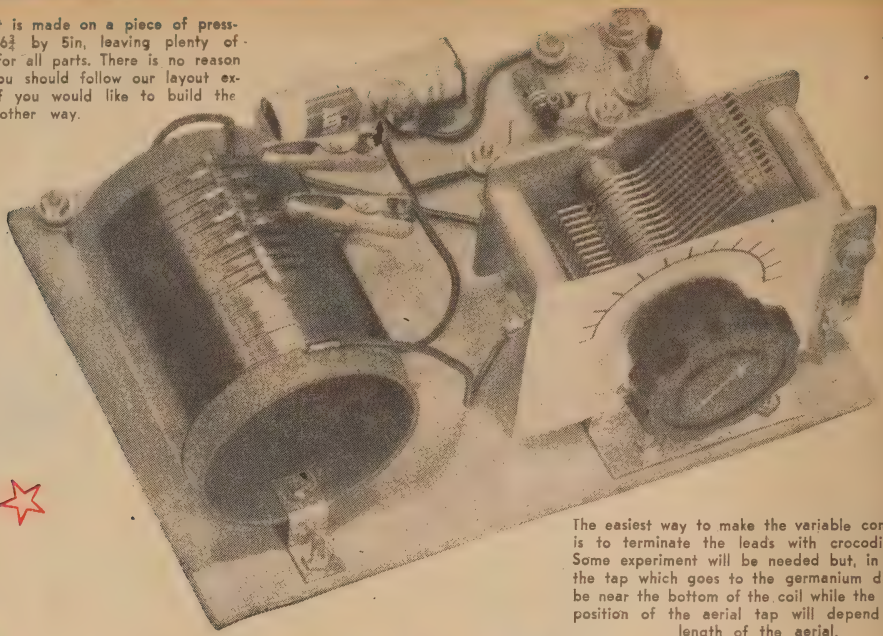


The set is made on a piece of press-wood 6¾ by 5in, leaving plenty of room for all parts. There is no reason why you should follow our layout exactly if you would like to build the set another way.

The easiest way to make the variable connection is to terminate the leads with crocodile clips. Some experiment will be needed but, in general, the tap which goes to the germanium diode will be near the bottom of the coil while the optimum position of the aerial tap will depend on the length of the aerial.

More Gain With A Transistor

The coming of transistors has revolutionised some aspects of electronics. Giant calculating machines can be made more reliable by their use, hearing aids smaller, and radio receivers more compact and economical. Even with very humble designs, transistors can be put to use.

EVEN the humblest of receivers, the crystal set, can be improved by the addition of a transistor amplifier. For one of the limitations of such a set is that we are limited to the amount of energy which the aerial receives directly from the station for the operation of the headphones.

We don't get any amplification from the crystal.

To boost up the signal from the set, we have in the past been forced to use a valve amplifier which, with its complement of batteries and coupling devices, might just as well have been made up as a single valve receiver in the first place.

USE OF TRANSISTOR

But the transistor quite changes the picture. We can get useful amplification from it very much more easily and conveniently, and incidentally take the opportunity to learn something about them in the meantime.

In our new small receiver described here, a transistor provides really worthwhile amplification, and as a result, range and volume are very much better than for the usual crystal set.

The extra components required are the transistor itself, a small dry cell and a resistor. Current drain from the battery is so small that it almost doesn't matter, while the maximum volume on strong stations is all that you can comfortably bear when using a sensitive pair of headphones.

Perhaps you already have a crystal set. We've described lots of them over the years. You can add the transistor amplifier to any of them and get a very much better performance.

To check on our results we took our new set into the laboratory and made some measurements on its performance with an accurate signal generator. The tests showed that the transistor amplifier enables the set to give the same output with an input signal about 1/15 the strength of that required using the crystal detector alone.

Although some people are very lucky and do much better, we generally find that the maximum range of a crystal set when receiving a powerful station is 1 miles, and possibly good reception at much greater distance. In most cases the crystal set fails because the signals are no longer strong enough to be audible, and can be restored to a useful strength by the addition of the amplifier stage. They are rarely lost in the first instance by unfavorable ratio of signal to electrical noise.

A GOOD AERIAL AND EARTH will make a big improvement to results. Make the aerial high and reasonably long. A good height is 30ft and the length may be from 30 to 100ft. An earth wire is essential for a crystal set. A wire should be run from the earth terminal of the set and firmly wrapped around a length of water pipe or metal alternatively, it can be wrapped aruond a length of water pipe or metal rod driven into the ground; if there is no water pipe within reasonable distance use insulators for the aerial if the wire is bare.

THE COMPONENTS

Before telling you how to make the set, it would be a good idea to say something about the parts. Radio, like many other subjects, has a specialised language of its own, and while the experts can string one technical term after the other and make sense, it's a bit tough if you aren't very clear what they mean.

An important part is usually referred to as the coil. It has an electrical property called inductance. It also has another property known as resistance.

We want the inductance, but the resistance we could better do without. Unfortunately we can't so we try to make the coil with the required inductance and

ttle resistance as possible. Factory-
e coils use special wire and have
r special features in order to make
il with the required inductance in a
l space.
this case we aren't very worried
it space, and can make a very effi-
t coil by winding ordinary enamelled
er wire around a piece of cardboard
akelite tubing. (The tubing is some-
is referred to as a former.)
icidentally, a coil with a high propor-
of inductance to resistance is known
high-Q coil. Sooner or later you
come across this term.

IL INDUCTANCE

nductance is affected by a number of
ors. It increases if the number of
is are increased, and the length of
coil, the gauge of wire and the diame-
of the former all have an effect. The
uctance must be fairly accurate or the
will tune over a different range of
velengths from those you intended.
you may miss out on a station at
er end of the band.
he size of former we specify is 2 1-8in
diameter, the wire gauge No. 22 B &
and when the turns are wound as
se together as possible, the coil will
about 2¼ inches long. If you happen
have some other materials on hand
wouldn't make a very great difference
the former diameter were between
out 2in and 2½in. The wire gauge,
, could be varied a few sizes either
y without upsetting things completely.
A big coil like this is just about as
icient as some of the smaller coils
ide with special materials, so that you
n't gain anything by paying out extra
oney for a factory-made coil.
A big advantage of the home-made
il is that it is easy to make taps for
nnecting the aerial and the crystal de-
tor. Different taps give the best results
th different aerials and different oper-
ng conditions. Sometimes the change
performance between one tap and the
xt is quite marked. More of this later.
The part which is used to tune the
ations is known as a variable capacitor.
has a characteristic called capacitance,
nveniently measured in a unit called
e picofarad (abbreviated pF). For this
t, the value of the variable capacitor
ould vary between a few pF and about
00 pF. Sometimes this value is ex-
ressed in microfarads — a unit 1000
mes greater. The maximum capacitance
f such a gauge would then read .0004
fds.
A variable capacitor suitable for the
t has two sets of parallel metal plates,
ne fixed to the frame and the other
novable by means of the control shaft
When the two sets of plates are inter-
meshed the capacitance is at its greatest
alue. It falls to a low value when the
ixed and moving plates are as far away
rom one another as possible.

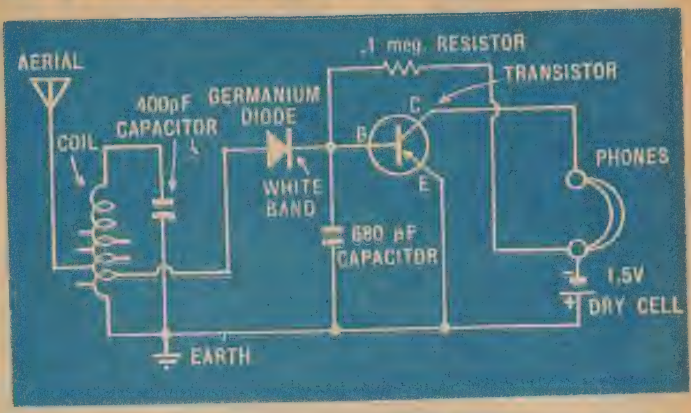
TUNING CONDENSER

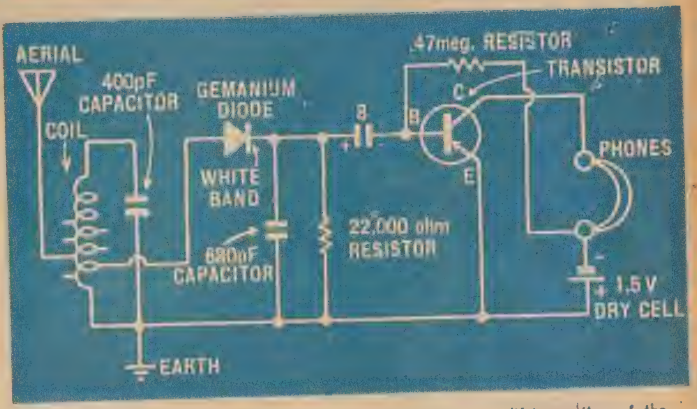
If you look closely at some variable
apacitors you will see that the moving
plates have a metallic connection to the
frame of the capacitor. There may even
be a special spring or spiral wire contact
to ensure that there is a good connection.
The fixed plates, on the other hand, are
insulated from the frame of the capacitor
either by special quality bakelite, ceramic
or other insulating material. For it to
work as intended, two connections must
be made to the capacitor, one to the
moving plates and the other to the fixed
plates.
This set would work with the connections either way around, but the accuracy of the tuning is least affected by the presence of the hand or stray metal objects if the moving plates are connected to earth.
The coil and the tuning capacitor together form a tuned circuit. For any given setting of the capacitor, the tuned circuit responds readily only to one particular wavelength. By altering the setting of the capacitor, we can select the wavelength to which the circuit responds.
This selectivity of the tuned circuit is a very valuable feature because it allows us to listen to the one station at the one time. Without, we would hear all stations in the vicinity at one time, which certainly wouldn't make for pleasant listening.
Perhaps the next item we should talk about is the crystal detector.

THE CRYSTAL

Years ago, the crystal would have been a piece of galena, carborundum, or some other natural crystal. A length of fine wire (called a catswhisker) was made to touch the surface of the crystal, and the idea was to move the wire around until the signals were loudest. In practice, it was a tentative process of adjusting the catswhisker and tuning until signals were the loudest.

ALTERNATIVE CIRCUIT DIAGRAMS



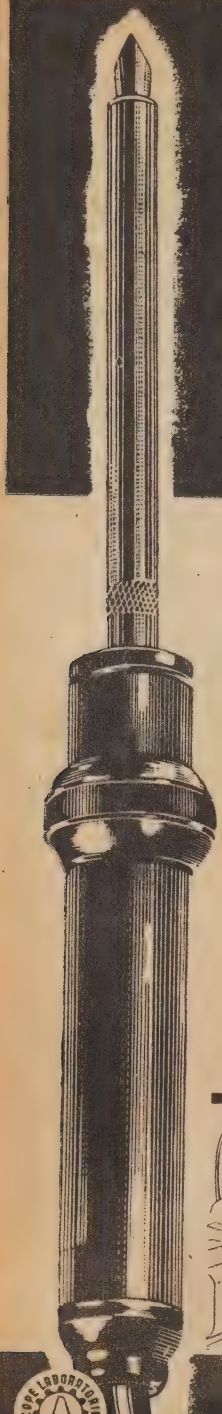


The circuit at the top is the original we used to test the amplifying action of the transistor. The lower one is a simplified version which works just as well and saves components. The diagram on page 31 corresponds with the lower circuit.

PARTS LIST

Here is a list of the parts you will need. Read more about them in the article.

Presswood baseboard 6¾in x 5in
Variable capacitor (400 pF approx.)
Crystal detector (see text)
Transistor (see text)
Fixed capacitor, 680 pF
Resistor, 0.1 megohm
Headphones
2 Crocodile clips
Coil former 2⅛in diam., 3in long)
Length of No. 22 B & S enam. wire
Pointer knob
⅛in nuts, bolt, washers and materials for aerial and earth.
1.5 volt dry cell, scrap sheet metal
Hook-up wire.



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2 **AMAZING SOLDERING SPEED.** Scope's unique design ensures rapid transfer of heat to job. Soldering is easier, more efficient with Scope.

3 **CONVENIENTLY USED IN AWKWARD POSITIONS.** As the heat is localised at the tip the iron can be used in a maze of delicate wiring without fear of burning the insulation of the wire or adjacent components.

4 **MORE TIME SAVED BECAUSE** Scope requires no frequent cleaning and tinning of the bit.

Scope is the most widely used Soldering Iron in Australia, and is now exported to England and America.

This electric soldering iron is absolutely safe. Because it operates on 2.5/6.3 volts, it is a simple matter to connect it to AC Mains through National Transformer (optionally supplied) or to a car battery.

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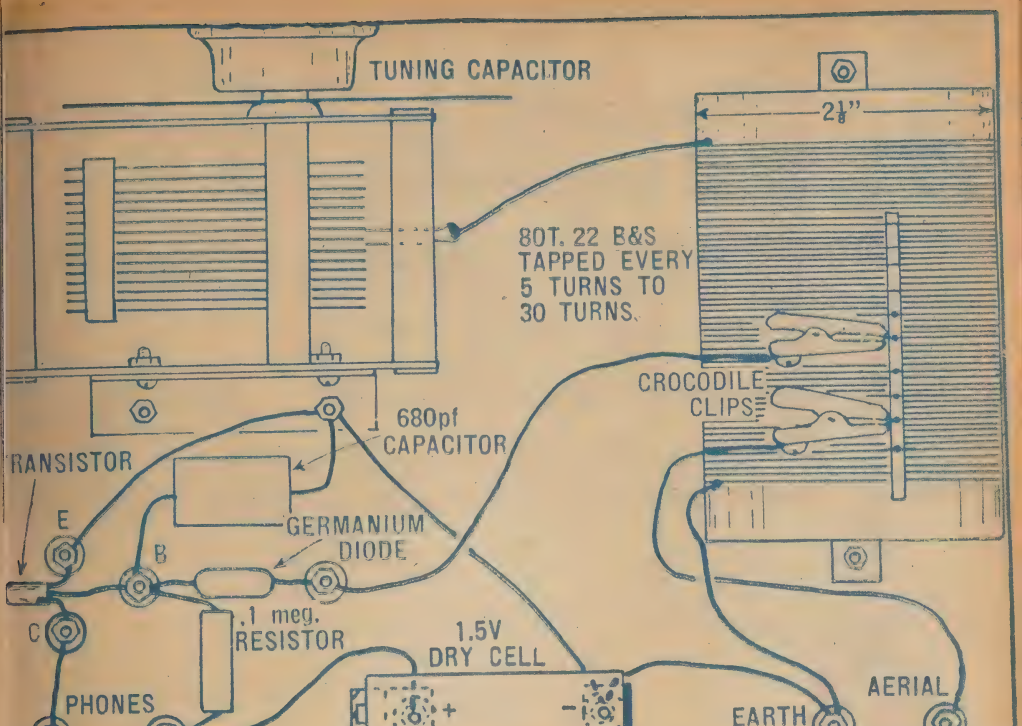

This drawing is exactly the same size as the piece of presswood on which the set is built. You can use it to trace the layout of the holes and the connections on to the piece of presswood or plywood for your own set.

Often, when you had just found the best spot, the adjusting lever would be bumped, and you would have to start all over again.

Nowadays there is a whole series of germanium diodes with fixed characteristics. Mostly they have glass envelopes and are able to withstand quite heavy shock and vibration with no changes in their operation. They are unaffected by humidity and only to a small extent by temperature, within the usual range in this country.

GERMANIUM DIODES

Best of all they gave signals just as loud as the older crystal diodes at their best settings.

Further, the price is about the same as for the older type diodes, leaving little argument as to which we would choose for the new set.

The name diode simply indicates that the device has two elements. There are also diode valves, triode valves and tetrode valves, the last two having three and four elements respectively.

Like valves the germanium diodes have type numbers to identify those with different characteristics. For some applications these different characteristics are very important, but in this case you would notice very little difference between the types.

A few of the types we can bring to mind at the moment are the OA70, OA73, OA81, OA85, GEX33, GEX44 and IN34. There are many others.

The theory of operation of the diode circuit is perhaps a bit too involved to discuss here in any detail. Briefly and roughly the signal from the aerial is of too high a frequency to operate the phones and the intelligence superimposed on it can be recovered by connecting it to the diode, which has the property of passing electric currents more easily in one direction than in the other.

After the crystal diode, the signals may be passed on directly to a pair of sensitive headphones. Or, by employing a transistor, another device made from germanium, it is possible to amplify the signals considerably giving the receiver a much better performance.

Here, again, the theory of operation of the transistor can be come quite involved and we won't go into any detail at this moment. Briefly, the transistor has three elements, which are called the emitter, the base and the collector. The elements can be connected in different ways depending on what you have in mind to do.

TRANSISTOR CONNECTIONS

For our purpose, the best arrangement is to apply the input signal between the base and the emitter and take the output from the collector and the emitter. Because the emitter is common to both the input and output circuits, it is referred to as the common emitter arrangement. Both the common collector and the common base configurations have special characteristics which are useful for other purposes.

A valve could be used to amplify the output of a crystal detector, and, while it would provide excellent results, it would do so only at the expense of a more complicated circuit and greater battery consumption.

With the valve, two batteries would be required, one for the filament and the other for the plate supply. The filament battery could have 1.5 volts output while for worthwhile gain the plate battery would need to have an output of about 9 volts.

LESS BATTERY DRAIN

Compare this with the transistor, which will give comparable amplification with a single 1.5 volt dry cell as power supply and requiring less than 1-100th the current of the valve filament alone.

There are quite a number of transistors available at the moment which will work well in this set. The one shown in the photographs (it is so small that you can hardly see it) is a type OC66.

In this circuit we don't even approach any of the maximum voltage and current ratings so that there is no need for worry on that score. The maximum temperature is given as 65 degrees centigrade which is equal to about 15

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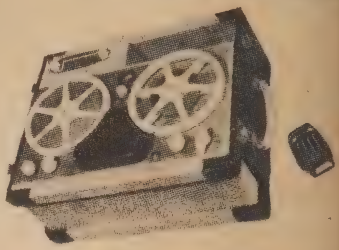

"STUDIO" Three speed. (1⅞", 3¾", 7½"), three motor, 7-inch reel model with 2 heads or 3 heads. With a 3 HEAD Recorder direct comparison between the incoming sound and the recorder sound can be made IMMEDIATELY, thus enabling the correct level, etc. 100 pc recording assured under all conditions.

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Simon "Sinfonic" 7½" single track, as new	£55	"FILMAG" 8 mm Unit (Demo)	£65
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TRUVOX Two-speed. A magnificent recorder with Radiotuner, new	£110	Here is Your Chance. Don't Miss it!!	
Magnegraph 7½" two track	£70	New plastic tape, 38/6. Aerovox Plastic Tape; extra sensitive, only 51/9 each.	

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ees Fareuheit—much higher than
ver likely to be encountered.
n electrical equivalent to the OC66
e OC71. It therefore may be used
no change in the electrical circuit
exactly the same performance. The
1 is bigger physically than the
6 but, of course, that is no objec-
OC71s may even be more plenti-
around the radio supply stores than
OC66s.

onnection to both transistors is
e by long wire leads which can be
ered directly into the circuit or
can be wrapped around terminals
we have done in this set. Small
ets are available and the transistors
be plugged into them when the
s are cut off short.

ransistors are sensitive to thermal
k so that if you decide to solder
into circuit it is a good idea to
the wire with a pair of long nose
s between the point of soldering
the transistor.

ANSISTOR CONNECTIONS

onnections for the OC66 and OC71
exactly the same. Three wires
anged in a straight line are iden-
ed by their spacing and also by a
dot at the collector side. The emit-
connection is opposite with the base
nection between the two.

Those who are familiar with valves
know that a bias voltage is often
uired in order to give the desired
erating conditions. A similar sort
thing is necessary in transistor cir-
its except that a current rather than
voltage bias is required.

The first of the two circuits we
ed needed a 0.47 meg resistor to
ply the required bias current, the
stal detector circuit being separated
m the transistor amplifier by means
a large value coupling capacitor.
e value of the capacitor was, in fact,
microfarad (8 uF) or 20,000 times
e value of the maximum value of
tuning capacitor. This large value
achieved in a small space by a
ecial process and the unit is called an
ectrolytic capacitor. (An electro-
tic capacitor must be connected a
rticular way so that if you decide to
the first circuit, note the polarity
arkings.)

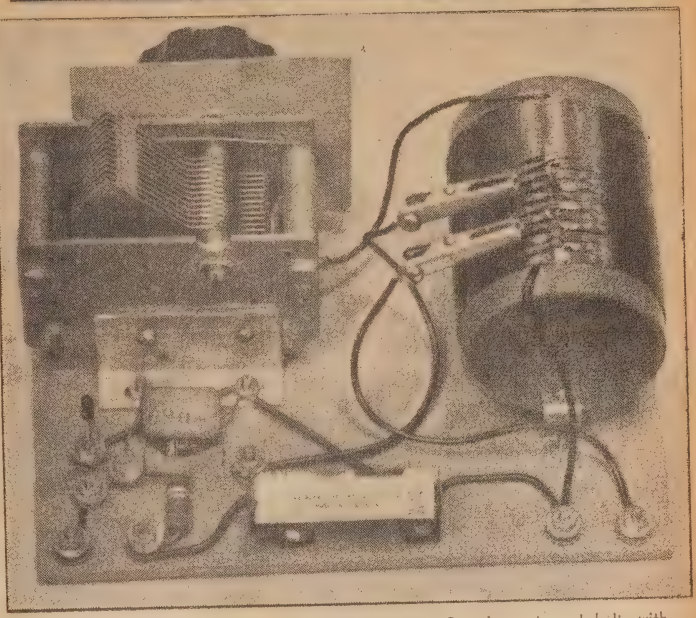
In the first circuit the audio signal
om the detector circuit is developed
ross the 22,000 ohm load resistor
th the 680 pf capacitor in parallel
complete the detection process. This
dio signal is passed on to the base
the transistor by the 8 mfd capacitor
hile the direct current circuits of the
tector and amplifier are quite separ-
e.

However, we found that it is pos-
ble to omit both the coupling capacitor
d the load resistor without any notice-
le difference in performance, pro-
ded the bias resistor is reduced from
47 meg to 0.1 meg. The reason for
is is that some of the bias escapes
ack through to earth via the ger-
anium diode which is connected in the
irection for easy conduction.

You may suggest that the diode be
onnected in the opposite direction
t this is not desirable because it
esults in a most unpleasant form of
istortion.

In the second circuit, the resistive
omponent inside the transistor between
he base and the emitter takes the

VIEW FROM BACK OF NEW SET



A view from the back clearly shows the small parts. By using nuts and bolts with appropriate washers instead of terminals you can save a few shillings. They work quite well and can be screwed down with the fingers.

place of the 22,000 ohm resistor. Current in the bias and the detector circuits are mixed up somewhat but the circuit works just as well as the earlier, and perhaps more legitimate one.

By the way, although the germanium diode must be connected into circuit the correct way around, it doesn't matter which way you connect either of the resistors or the 680 pf capacitor. This last capacitor is not very critical and any mica or paper capacitor around about the specified value will do a good job.

BASEBOARD

If you would like to copy the layout of the set in the photographs, cut out a piece of presswood or three-ply about 6¾in by 5in. Bakelite could also be used and is a good insulator but the difference between the three materials is small enough not to be noticed in the case of a set like this.

The only lead which is likely to be affected by leakage through the insulating material is the one from the top of the coil to the fixed plates of the tuning capacitor and this one can go direct without touching the chassis.

Drill 1/8in diam. holes in the baseboard in the positions shown or slightly different positions if necessary in order to accommodate the components you have. There are plenty of older type tuning capacitors which would do the job just as well as the type we have used.

The torch cell shown in the photographs is one of the smaller types. The current drain is so small (about 1/3 of a milliamp) that even the smallest dry cell will have a very long life.

It is supported between two right angle pieces made from sheet metal. You switch the set on and off by pushing the battery into circuit and taking it out. We left the switch out with the idea of saving on cost.

Assembly of the rest of the set is simply a matter of following the layout diagram. You can twist the wires around the 1/8in bolts for anchor points as we have done or tag strip can be used and the connections made by soldering.

The aerial lead which goes to the coil and the lead from the germanium diode to the coil will almost certainly require adjustment for optimum results on different stations and with different aerials.

Probably the easiest way to make the variable connection is to terminate the leads with crocodile clips which can be clipped to whichever tap gives the best results.

Some experiment will be needed but, in general the tap which goes to the germanium diode will be near the bottom on the coil while the optimum position of the aerial tap will depend on the length of the aerial.

For long aerials the best position will be near the bottom or earth end of the coil while if you are limited to a fairly short aerial you will get louder signals by moving the aerial connection further up the coil.

The transistor amplifier gives the new set a big advantage over an ordinary crystal set because you can often get sufficient volume with the aerial tapped well down the coil where the selectivity is good.

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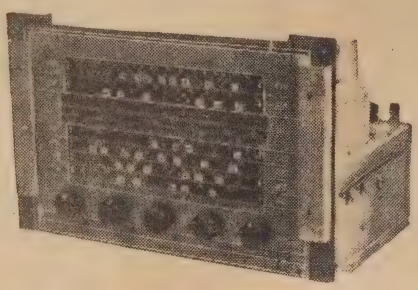

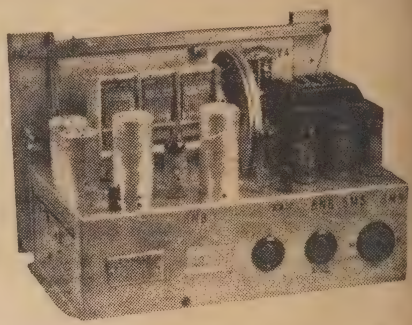

NEW ● Ultra modern circuit using nine high gain valves including "magic eye" tuning indicator. Permatuned iron cored coils and intermediates giving excellent interstate reception and a short wave range of 12,000 miles. All valves used are the new Philips nine pin innoval series.

NEW ● Tone control and audio stages incorporating the Mullard 5/10 amplifier circuit with separate bass and treble controls giving + or — 15db. boost or cut at 50 cycles L.F. and 10,000 cycles H.F., combined with push-pull output with inverse feed-back gives you really high fidelity reproduction from your radio or favorite recordings.

NEW ● Dual speaker combination using a heavy duty woofer (12in M.S.P. Jensen AU54 special) with matching 6in tweeter and cross-over network giving a frequency response of 46 to 13,000 cycles. Speakers are mounted coaxially making only one 11in mounting hole necessary. If required the new Magnavox high fidelity twin coned speaker can be supplied.

NEW ● Large calibrated edge-lit dial in plate glass (11in x 7in) with main stations of each State in prominent type. Dial fitted with counterweight drive giving smooth tuning. Indicator lights are fitted showing which band is in operation. Dial can be supplied in cream, black or brown with matching knobs and escutcheon to suit contemporary blond or walnut finished cabinets.

NEW ● Sensitive "magic eye" tuning indicator (EM80) making tuning simple and positive even on interstate, overseas and country stations.

All chassis are wired for the fitting of an F.M. tuner or tape recorder, special plug being provided on back of chassis, also pick-up terminals and outlet for grammo motor. Power switch is fitted to volume control, radiogram switch combining with wave change switch. Audio end of set can be used with T.V. receiver if required.

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A group of modern electrolytic capacitors which allow high capacitance in a small space. These range from 16 mfds at the bottom to 100 mfds at the top. Shown also is a clip for upright mounting.

Capacitors vital in Electronic Circuits

Before one can progress very far with a study of electrical circuits, it is necessary to have some knowledge of yet another property, namely CAPACITANCE. Together with resistance and inductance, which have already been discussed, capacitance plays a vital role in the operation of all radio circuits.

TO understand just what capacitance is it is necessary to recall certain earlier discussion of conductors and insulators.

It was pointed out that an atom consists of a positive nucleus, around which revolve one or more planetary electrons.

The outer planetary electrons are not always intimately bound to the nucleus and, in so-called conductors, an externally applied E.M.F. can cause a definite drift of electrons from one atom to the next along the length of the material.

The electron movement is always toward the positive pole of the applied E.M.F., in accordance with the general law that unlike charges attract, like charges repel.

With substances known as insulators, this migration of electrons cannot easily be initiated and, to all intents and purposes, one can say that there is no electron movement along the length of an insulator, despite the application of even a substantial E.M.F.

Nevertheless the application of a voltage across a piece of insulating material produces another interesting effect. Consider figure 1, in which a piece of insulating material is placed between two metal plates, connected to the poles of an electric battery.

The plate connected to the positive pole of the battery can be expected to exert some attraction for the electrons within the structure of the insulating medium; likewise, there is a force of repulsion between the electrons and the negative plate.

The very nature of the atoms prevents any actual migration of electrons, but planetary electrons are found, instead, to describe an orbit which is eccentric with respect to the nucleus.

Reversal of the voltage causes the planetary electrons to describe an orbit displaced in the opposite direction.

Only two or three electron orbits are illustrated in figure 1 but there are countless atoms and electrons in any given piece of insulating material.

At the instant when the voltage is applied to the two metal plates, countless planetary electrons are simultaneously displaced and there is a brief but evident flow of current. This is known as the DISPLACEMENT current.

A unit as illustrated in figure 1 is known as a CAPACITOR or, to use an older term, a CONDENSER.

ESSENTIALS

In its simplest form, a capacitor comprises two conductors located in proximity but insulated the one from the other. The insulating medium is referred to as the DIELECTRIC.

In general, the conducting surfaces take the form of metal plates or foil, while waxed paper and mica are common dielectric materials. Alternatively, the metal plates of a capacitor may simply be separated by a free air space and, in this case, air is the dielectric.

If a capacitor is connected across the terminals of a battery, as in figure 1a, a certain displacement current flows for a brief interval of time, and the planetary electrons take up an orbit eccentric to the nucleus.

If the capacitor is now disconnected from the battery, the unnatural condition within the dielectric material is maintained. There is still a surfeit of electrons at the plate originally connected to the negative battery terminal and, provided there is no leakage path for an electric current between the plates of the capacitor, the unbalanced condition will be maintained indefinitely.

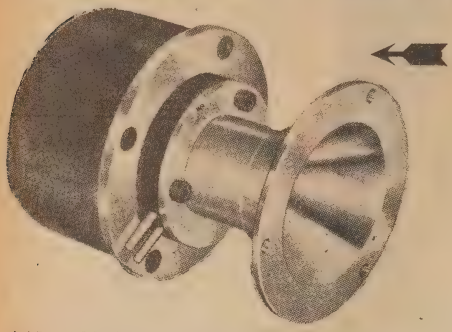
A capacitor in this condition is said to be CHARGED. There is a surfeit of electrons at one plate and an accumulation of positive ions at the other (figure 1b). The dielectric is under a condition of strain with its planetary electrons abnormally displaced.

However, if the two charged capacitor plates are joined by an external conductor, electrons move along it to correct the unbalanced charge on the plates and the planetary electrons in the dielectric resume their normal orbits. The capacitor is then said to be DISCHARGED.

Goodmans

MULTI-CHANNEL FULL RANGE SYSTEMS

GOODMANS THREE WAY LOUD SPEAKER SYSTEM



MIDAX MID-RANGE PRESSURE DRIVEN HORN UNIT

This entirely new producer is designed for high efficiency low distortion coverage of the middle register in multi-channel high fidelity systems. It consists of a pressure driver and horn unit designed to cover a total frequency range of 400 c.p.s. to 8 Kc/s. The efficiency of Midax is such that it can be employed with any direct radiator up to 18 inches in diameter.

SPECIFICATION

FREQUENCY RANGE .. .. .. 400 c.p.s. to 8 Kc/s
IMPEDANCE .. .. 15 ohms at 400 c.p.s.
SYSTEM POWER HANDLING CAPACITY .. 25 watts.
CROSSOVER FREQUENCY .. 750 c.p.s. and 5000 c.p.s.

. . . TREBAX HIGH FREQUENCY PRESSURE UNIT

Trebax is a new high efficiency pressure driven re producer covering the treble register in multi-channe High Fidelity systems. The frequency coverage i achieved with complete freedom from irregularitie in response. The efficiency of TREBAX is such tha it may be used with the most efficient bass and mid range units.

SPECIFICATION

FREQUENCY RANGE .. .. 2,500 c.p.s. to 16,000 c.p.
IMPEDANCE .. .. 15 ohms at 10 Kc/
SYSTEM POWER HANDLING CAPACITY .. .. .. 25 watt
CROSSOVER FREQUENCY .. .. 5 Kc/

AUDIOM BASS LOUDSPEAKER

The AUDIOM series of loudspeakers are robust single cone units and feature the refinements necessary for very low distortion reproduction of the bass register and the high reliability under full load conditions. The cross-over points may be placed at any frequency below 800 c.p.s. depending on the requirements of the other units.

SPECIFICATION

	AUDIOM 60	AUDIOM 70	AUDIOM 80
FLUX DENSITY	14,000 GAUSS	17,000 GAUSS	14,500 GAUSS
BASS RESONANCE	35 c.p.s.	35 c.p.s.	35 c.p.s.
POWER HANDLING CAPACITY	15 watts	20 watts	25 watts
IMPEDANCE AT 400 c.p.s.	15 ohms	15 ohms	15 ohms

TWO WAY SYSTEM

AXIOM LOUDSPEAKER USED AS MID AND BASS-RANGE UNITS

Owners of the well-known AXIOM 150 Mk. 11 or AXIOM 22 Mk. 1 loudspeakers can also take advantage of the pressure driven units by using the existing speaker to handle the bass and middle registers and adding a TREBAX for the high frequency part of the spectrum. MIDAX could also be inserted into the system if required, thus leaving the AXIOM loudspeaker to handle the bass register only.

REMEMBER! The Axiom twin cone is the foremost full range single unit speaker. 30-15,000 c.p.s.

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Obviously then, a capacitor has the ility to store electrical energy.

If the capacitor be connected across source of fixed voltage, the displace- ent current flows for only a brief in- rval of time and then ceases. How- er, if the applied voltage is con- nuously varied at a given rate over definite interval of time, the dis- acement current through the capacitor found to vary in sympathy with it.

This must obviously be so, for a adual increase or decrease in the pplied voltage will cause an increase r decrease in the electron displace- ent, and therefore result in a con- nuing flow of displacement current.

EFINITION

On this statement is based the means dopted to define the capacitance of ny given condenser — or capacitor.

When a change of one volt per second cross a capacitor produces a dis- lacement current of one ampere, it is aid to have a capacitance of one farad.

Just as resistance is measured in ohms, nd inductance is measured in henries, o is capacitance measured in farads.

In actual practice, the farad is too arge a unit for ordinary radio and lectrical work, and the unit most com- nonly used is the MICROFARAD, which is one-millionth of a farad.

Typical capacitors employed in radio eceivers range from something like 25 microfarads down to .00005 micro- farads, although still larger and smaller units are not uncommon.

To save unwieldy decimals, small capacitance values are sometimes writ- ten in millionths of a microfarad, name- ly in MICROMICROFARADS. Thus, .0001 microfarad becomes 100 micro-

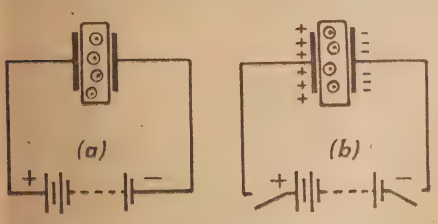


Figure 1 Showing how the electron orbits in the dielectric are displaced with the application of a voltage to the metal plates. With the voltage disconnected (b), the charge remains.

microfarads. The value .00002 micro- farad is written as 20 micromicrofarads.

To simplify expression, various ab- breviations for the word microfarad are commonly employed.

One is the purely Anglicised abbrevia- tion "mfd".

SYMBOLS

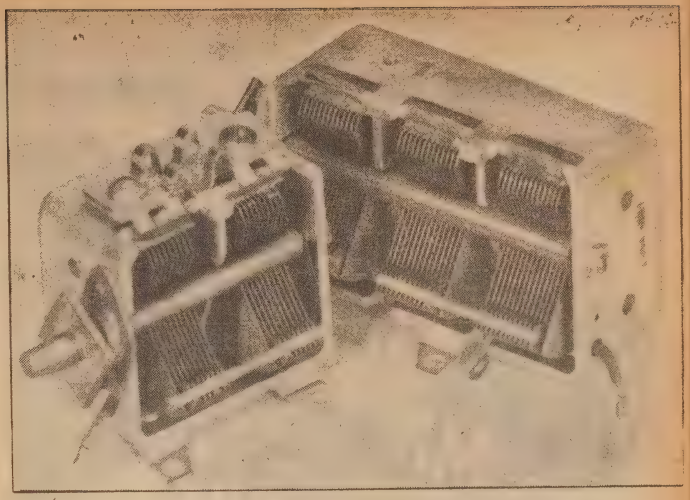
Another follows technical practice in using the Greek letter mu to mean one millionth, this being coupled to a capital F for Farad.

Typesetting difficulties may cause the English letter u to substitute for the Greek mu, giving the symbol "uF".

Actually there should be little dif- ficulty, knowing this, in recognising any of the ordinary abbreviations.

By the same token, micromicrofarad is frequently abbreviated to "mmfd" or "uuf".

During the war and since, the term micromicrofarad has been replaced in



Typical gang capacitors sa used today for receivers having several tuned circuits. The 2-gang type has adjustable trimmers at the top.

some quarters by picofarad, abbreviated to "pF".

Thus mmfd, uuF and pF all signify the same unit of capacitance — one mil- lionth of a microfarad.

The capacitance of a condenser — or capacitor — depends on several factors, which are fairly obvious.

First is the total area by which the plates or elements actually overlap; capacitance increases directly with area.

Secondly, capacitance varies inversely as the distance between the plates; the smaller the separation, the greater is the capacitance.

The material occupy- ing the space between the plates also has a marked effect on capacitance. Air is the reference standard, but the insertion of mica, glass, waxed paper, etc., increases the capacitance substantially.

The ability of an in- sulator to multiply the capacitive effect between condenser plates of given area and spacing is expressed by its DIELECTRIC constant.

We have assumed, thus far, that only two plates are involved, whereas any number of plates may be arranged sandwich fashion, as illustrated in figure 2.

There is a capacitive effect between plate a and plate b, between plate b

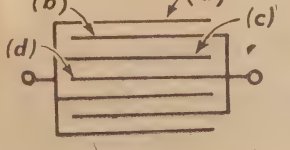


Figure 2. Many capacitors have plates arranged sandwich fashion, as shown; they may be separated by air or by a solid dielectric material.

and plate c, between c and d, and so on; the total capacitance of the unit is the sum of all the above.

In actual practice, only low capaci- tance condensers employ two simple flat plates. Most employ a multiplicity of plates, or some other arrangement which will give the required capacitance in a mechanically convenient form.

In producing a component any given figure of capacitance, it is necessary to consider the amount of space which the complete unit will occupy, the mechani- cal rigidity of the structure and also the voltage which can be impressed across it without danger of breakdown.

If the spacing between the plates is too small, or the dielectric material un- suitable, the stress set up may be so great as to disrupt altogether the structure of the dielectric. This would allow a flow of current and consequent charring rendering the capacitor un- serviceable.

MICA AND PAPER

In practice, capacitors rated up to about .001 mfd. (1000 mmfd) are usually of the so-called mica type. Small strips of thin metal are sandwiched between pieces of mica insulation, alter- nate metal strips being joined to- gether at the ends, similar to figure 2.

The whole assembly is held together with a metal clamp, or sealed with wax into a ceramic case. Many manu- facturers mould the complete assembly into a bakelite case.

Connection to the two sets of plates is provided by terminals or short copper wire leads — commonly called "pig- tails."

Different values of capacitance are obtained by varying the size and number of the plates, and the thickness of the insulation between them.

Ordinary mica capacitors are com- parable in size to a postage stamp and up to a ¼in thick. They will operate safely with applied voltages up to about 500, and their capacitance value is usually stamped directly on the case. Some brands, however, employ a color

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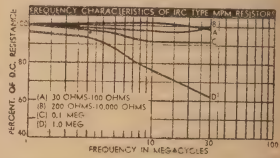
TYPE MPM
MINIATURE LOW POWER

IRC Type MPM Resistors are miniature units suitable for high frequency receiver and similar applications. Resistor body is 7/32" by 0.100" (over cups), and the active resistance section is 3/8" long.

RESISTANCE VALUES: 30 ohms to 1.0 megohms. **TOLERANCE:** Standard ±20%; Special ±10%. 5% not available. **POWER RATING:** 1/4 watt, at 40°C. ambient temperature. **MAXIMUM VOLTAGE RATING:** 200 volts peak. **CAPACITY BETWEEN TERMINALS:** 0.015 Micromicrofarads. **TEMPERATURE COEFFICIENT OF RESISTANCE:** Approx. 0.04% per degree over temperature range of —55°C. to +80°C.


FREQUENCY CHARACTERISTICS OF IRC TYPE MPM RESISTORS
PERCENT OF D.C. RESISTANCE
FREQUENCY IN MEGACYCLES
(A) 30 OHMS-100 OHMS
(B) 200 OHMS-10,000 OHMS
(C) 0.1 MEG
(D) 1.0 MEG

The range MPF to MPR Medium and High Power High Frequency Resistors, rated between 2 and 90 watts, are designed for frequencies above those of conventional resistors. They are suitable for such applications as broad band RF amplifiers, RF probes, rhombic antenna terminating resistors, dummy loads for transmitters and dielectric heating equipment, television side-band filters, surge generator and other circuits involving steep wave fronts, high frequency measuring circuits and radar pulse equipment.

RATINGS indicated are maximum based on free air operation at 20°C. ambient. **DERATING** curve is available on application. **TEMPERATURE COEFFICIENT:** —.005%°C. for low values, —.07%°C. for high values. **HUMIDITY:** Several protective coatings of special varnish, each baked at high temperature, provide protection against effects of abnormal humidity.

TYPE	Power Rating	Peak Voltage Rating	Minimum Available Resistance at 20% Tolerance	Maximum Available Resistance at 20% Tolerance	Dimensions	
					Ceramic Length	Resistor Body Diameter
MPF	2 watts	500	20 ohms	1.5 megohms	1-3/4"	5/16"
MPG	4 watts	500	20 ohms	1.5 megohms	2"	9/16"
MPJ	5 watts	1000	35 ohms	3.0 megohms	3"	9/16"
MPP	10 watts	1750	25 ohms	2.5 megohms	4-1/2"	3/4"
MPA	20 watts	2750	35 ohms	4.0 megohms	6-1/2"	1-1/8"
MPO	30 watts	4750	50 ohms	5.0 megohms	10-1/2"	1-1/8"
MPR	90 watts	8500	60 ohms	6.0 megohms	18-1/2"	2"

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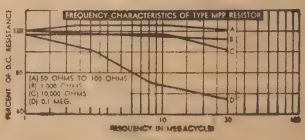

FREQUENCY CHARACTERISTICS OF TYPE MPP RESISTOR
PERCENT OF D.C. RESISTANCE
FREQUENCY IN MEGACYCLES
(A) 50 OHMS TO 100 OHMS
(C) 10,000 OHMS
(D) 0.1 MEG

le to distinguish one capacitance from ither.

For capacitance values above about mfd., the bulk of a mica assembly ins to multiply unduly and a more ivenient and economical form of acitor is usually employed; this is paper tubular type.

Two thin metal ribbons (usually minium) are rolled tightly together h a special oiled or waxed paper arating them. The two strips of l serve the same purpose as the metal tes previously assumed, while the xed or oiled paper is the dielectric. The capacitor is usually wound with respective foils overlapping the paper each end. The overlapping portion the foil is pushed into a compact mass d soldered to a pigtail for connection the external circuit.

ONSTRUCTION

Squeezing together the ends of each il ensures a short path between the gtail and all portions of the metal foil. connection were made only to one end, ch foil would resemble a flat coil d exhibit an undesired inductance, as ell as the required capacitive effect.

The ultimate capacitance depends on e length of the foils, the distance by hich they overlap and the characteris- s of the paper dielectric.

Paper tubular capacitors are gener- ly sealed with a special wax into round ikelite tubes from one to two inches ng and up to about one inch in ameter.

They are stamped with their nominal apacitance value and also the maxi- um DC voltage which they will with- and across their terminals. Most rdinary paper tubular capacitors are ated to operate with a maximum volt-

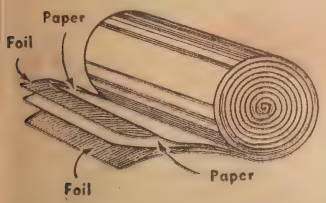


Figure 3. In paper tubular capacitors, two lengths of metal foil are tightly rolled with a special paper to separate them.

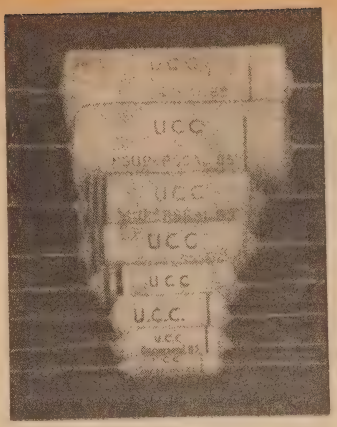
ge of about 400 DC but ratings as low as 100 or as high as 600 volts are ot uncommon.

They are made up in a variety of values between .001 and 0.5 mfd., the particular value being marked on the case.

CAN TYPE CAPACITORS

Paper capacitors of capacitance larger than 0.5 mfd are almost invariably sealed into rectangular metal cans in- tended for bolting to a radio receiver chassis. These can-type paper cap- acitors are not uncommon in values up to about 4 mfd, a limit set, as much as anything, by physical bulk.

The can type of construction is actually used on occasions for smaller capacitance values than 0.5 mfd and, in some cases, several distinct units are mounted for convenience in the one can.



A series of tubular paper capacitors which generally range up to .5 mfds and carry many voltage ratings from 100 to 600 volts working. The ends marked with dark bands are connected to the outside foil and are connected to the low potential side of the circuit.

and provided with separate leads or terminals.

Modern radio circuit practice often calls for capacitors having a capacitance of 8 or more microfarads and capable of operating with applied voltages to 500 or 600 volts DC.

To produced rolled paper capacitors to this specification would be a costly job, besides which the finished article would be very bulky indeed.

The difficulty has been overcome by the development of the so-called ELECTROLYTIC capacitor, which makes use of the fact that aluminium and some other metals form extremely thin layers of an insulating oxide, when immersed in certain electrolytes.

An electrolytic capacitor, in its simplest form, consists of shaped aluminium plate immersed in a liquid electrolyte, itself a conductor of electricity.

MAKING ELECTROLYTICS

During the process of manufacture, the capacitor is connected to a source of direct current and FORMED. In other words, the aforementioned layer of oxide is caused to form on the aluminium electrode by electro-chemical action.

Once the forming process is complete, the capacitor ceases to pass appreciable current, since the oxide coating forms an insulating layer between the aluminium electrode and the electrolyte in which it is immersed. The aluminium is, therefore, one electrode, the electrolyte the other, and the oxide coating is the dielectric.

The thickness of the coating and the voltage which the capacitor will withstand is determined by the method of manufacture.

Since the dielectric is produced and maintained by electro-chemical action, it is necessary to use an electrolytic capacitor with the electrolyte connected to the negative side of the voltage source, and the aluminium electrode to the positive side.

Ordinary types must not be used in reverse polarity, or connected to a purely AC circuit.

OLD AND NEW

The oxide coating is actually a less efficient insulator than say, mica or paper, so that a certain small leakage current has usually to be tolerated. The coating and the electrolyte are likely to deteriorate after a few years' service, necessitating replacement.

For all their disadvantages, electrolytic capacitors are widely used, because they make possible large capacitance values with economy in both space and cost.

In old-style can-type electrolytic capacitors, the electrolyte is contained as a liquid within a sealed metal can — usually aluminium; this can provides

Figure 4. A typical can-type electrolytic capacitor and, in the foreground, a semi-dry tubular electrolytic. The schematic symbol is usually marked "plus" and "minus" as shown.

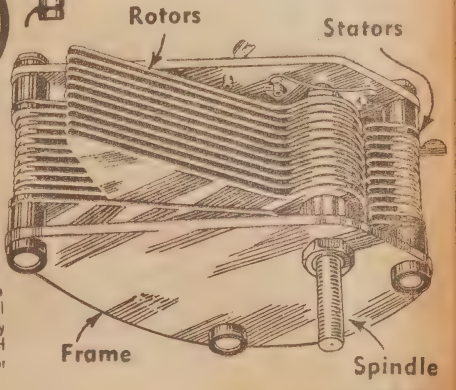


Figure 5. A typical variable capacitor, as used in small receivers. This type was very popular in the early days of radio, and is still useful for beginners' experiments.

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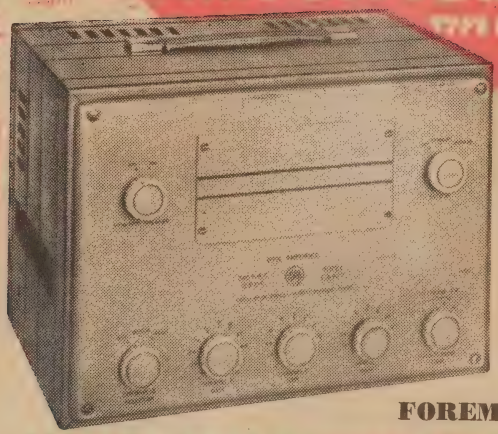
5 WATT AMPLIFIER

TYPE PA 828

20 WATT AMPLIFIER

TYPE PA 829



Type PA829 20 watt mains or 12 volt battery amplifier provides all facilities necessary for P.A. Hiring.

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trical connection to the electrolyte. positive aluminium electrode is ported centrally within it, being ghened, fluted, crimped or otherwise ated to present the maximum possible face area to the electrolyte.

Can-type electrolytics have now given ce almost completely to tubular es, employing an aluminium foil led with an absorbent material ked in electrolyte.

These "dry" electrolytic capacitors en resemble the larger paper tubular es, although others are assembled thin small cans for mounting on the assis. Electrolytic capacitors are dis-guished usually by the description on e container, by the comparatively high pacitance rating and by the "plus" d "minus" markings at either end.

An almost universal feature in the ning portion of radio receivers is one more variable capacitors (or variable ndensers) whose capacitance value is pable of easy adjustment.

HE COMMON TYPE

The most common type employs a umber of fixed and a number of mov-g vanes which mesh with one another a greater or lesser extent.

The fixed vanes, which are rigidly ounted on a supporting framework, re referred to as the STATOR plates. he moving vanes, locked on a re-olving shaft, are known as the ROTORS.

A variable capacitor must be well onstructed mechanically, so that the wo sets of plates will not foul one an-ther at any position.

The plates of variable capacitors are haped in various ways to obtain a pecific relationship between capacitance nd the number of degrees through vhich the control shaft is rotated. Pur-ose of this is to spread the stations more evenly across the tuning dial of he completed receiver.

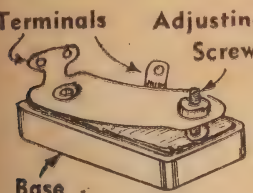


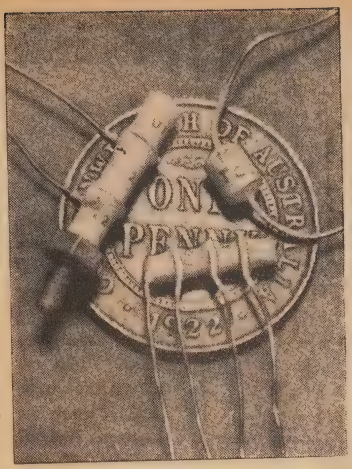
Figure 6: A semi-variable capacitor, in which the capacitance is altered by means of an adjusting screw.

Variable capacitors may be made singly but two, three or four units are often mounted within the one frame-work and on the one shaft, so that they operate together. Multiple units coupled together in this way are commonly called GANG CAPACITORS or GANG CONDENSERS.

Ganged capacitors commonly used in the tuning circuits of radio receivers have a maximum capacitance of about .0004 mfd but only about .00002 mfd. in the fully open or minimum position.

This capacitance is achieved with anything from 17 to 23 plates in all, the ultimate capacitance depending on the number of plates, the area enmeshed and the spacing between them.

Smaller variable capacitors of the same general pattern are used for special purposes. Some employ a smaller number of conventional-sized plates; others use a large number of small plates, comparable in size to a penny, cut across the centre.



These ceramic insulated capacitors are valuable particularly for VHF work. One can be bolted directly to the chassis and has two sections used for by-passing. The one with four wires has three sections. The wire at the end is the earth connection. The small single condenser is for small values and has only one unit useful either for coupling or bypass circuits. In all cases, self inductance is extremely small.

Some circuit applications call for capacitors which are capable of only occasional adjustment within certain limits. Variously described as SEMI-VARIABLE or SEMI-FIXED capacitors, the most common is the mica compression type.

Such capacitors incorporate two or more metal leaves, insulated with mica and normally held apart by spring tension. Adjustment of a screw forces the leaves closer together, increasing the capacitance.

These TRIMMER or PADDER condensers are comparable in size to a postage stamp, and about one quarter-inch thick. They are widely used to effect adjustments made necessary by the use of ganged tuning capacitors.

For critical purposes, mica compression capacitors are not above reproach, and various other types of trimmer capacitors have been devised. Some of these operate on the priciple of a metal piston or plunger moving into, but insulated from, a metal cylinder.

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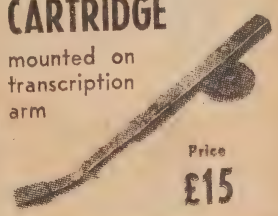

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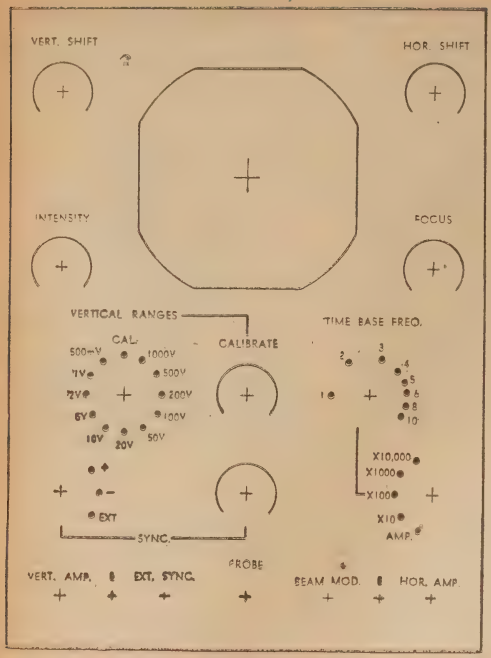

Figure 1: A drawing of the front panel of the new CRO identifies control panel positions which were not clearly visible in last month's photograph. Controls are cut to the minimum consistent with versatility.

NEW WIDE BAND OSCILLOSCOPE

This, the third article dealing with our new television cathode ray oscilloscope, deals with the all important vertical amplifier, explaining the reasons for the choice of circuit constants. A table of operating voltages is included and gives a definite check on the performance of your complete instrument.

by Maurice Findlay

A GENERAL discussion of the problems of designing a wideband oscilloscope appeared in the February issue. The article in the March issue dealt with the time base and power supply circuits in some detail. The magnetic shielding was also discussed.

From the February article you will remember that limits are imposed on the frequency range for equal amplification, mainly because of the stray capacitance between wiring components and ground, together with input and output capacitances of valves.

LOW LOADS NECESSARY

In order to achieve the wide frequency response required, the amplifier load resistors are assigned a relatively low value. Stray capacitances then do not have a reactance comparable with the load resistance except at relatively high frequencies. Various arrangements of peaking inductors can be employed in order to make a specified frequency response easier to achieve.

The most serious difficulties occur in the output stage which is called upon, not only to have a level frequency response, but to deliver a high output voltage over a wide frequency range. To develop a high output voltage across a low value load resistance it is necessary to have high current.

When the problem is worked out with the practical values required, it is found that the output stage must use power valves, high dissipation dropping resistors and, since the power must come from somewhere, a heavy duty power supply is needed.

As we mentioned in an earlier article, the problem of designing an output stage for a wideband oscilloscope resolves itself into a matter of compromise between various conflicting factors. For a given total high tension current you can take your choice between frequency response and amplitude of undistorted deflection. That is, by reducing the load resistor you can improve the frequency response at the expense of pattern size or vice versa.

Alternatively, for a given deflection amplitude the current requirements increase as the load resistor is reduced to improve the frequency response characteristics.

In the case of our new oscilloscope the starting point for design is the 5BP1 cathode ray tube. Although it is often operated with lower voltages, we feel that the better definition gained by using the maximum permissible EHT of 2KV is well worth while.

Some of the later CR tubes and also the disposals type VCR97 have more attractive specifications than the 5BP1 and therefore a design for the latter will have some reserve if you wish to use other tubes.

The next job is to make an estimate of the total capacitance into which the output stage will have to work. Information published by valve manufacturers is a help, but there is a certain amount of error due to factors for which it is difficult to allow.

However, it would be reasonable to allow about 12 pF for the deflector plates of the CRT, 7 pF for the output capacitance of a typical video power pentode plus about 10 pF for strays, making a total of about 29 pF. The last assumes that the wiring is very short and direct but allows for sync. connection.

For a normal uncompensated amplifier, the response is 3db down at the frequency at which the reactance of the shunt capacitance is equal to the load resistance. From previous experience it is known that the upper 3db point can be increased in the ratio of 1.5 to 1 by a correctly adjusted shunt peaking circuit.

CALCULATION

Therefore, if with a shunt peaking circuit, a response curve which is 3db down at, say, 3 Mc/s is required, the load resistance must have a value such that it is equal to the reactance of total shunt capacitance at 2 Mc/s. A short slide rule manipulation will show that for the values given, the load resistance is 2750 ohms approx.

From the manufacturer's data the deflection factor for a 5BP1 with 2 KV EHT is 76 volts/inch. The minimum undistorted deflection which could be regarded as reasonable for a 5-inch cathode ray tube is 4 inches peak-to-peak. There

e, with a push-pull output circuit, :h output valve must be able to de- er 152 volts peak-to-peak.

Given a pentode valve with ideal char- eristics for the purpose, the standing ıte current must obviously be at least mA for 152 volts peak-to-peak to be veloped across 2750 ohms.

The minimum high tension supply 152 volts.

On the basis of plate current alone, ; job of deflecting the electron beam beyond the capabilities of most of ; smaller receiving valves. We must erefore consider some of the more adily available video power pentodes. ıe most likely appear to be the 6CH6, CK6 and 12BY7. After considering ısely all aspects, we decided on the CK6.

NAL VALUE

Further, we found in practice that re- ponse to 3 Mc/s could be obtained ith a 3000 ohm load and this value ppears to be the best choice. Possibly e total shunt capacitance was a little ss than estimated.

Looking now at the Va/Ia family of ırves for the 6CK6 it will be seen that ır a 3000 ohm load with a 250 volt ıpply, the valve will deliver about 225 olts peak-to-peak between zero grid ias and cut-off.

With the bias set at -5.5 volts the eady plate current will be 35 mA and ıe valve will actually be able to deliver bout 220 volts peak-to-peak. By noting ıe voltage at the plate of the valve ır equal increments of grid bias over ıe range it will be seen that the re- uired 150 volts peak-to-peak will be elivered with low distortion.

At this point, it is worth observing that ıe eye is not very critical of the type f distortion introduced by valve non- nearity and therefore it is not often reasonable proposition to include spec- al negative feedback loops as are sually included in audio power ampli- iers these days. In any case, the "long- ailed pair" arrangement used to obtain balanced output does have some in- ierent negative feedback and thus tends o keep the overall distortion low.

A cathode ray oscilloscope can be ısed for the detection of small amounts of distortion by indirect means, some- imes in conjunction with other instru- nents.

DISSIPATION

Another aspect of the operation of the output valve worth noting is that at no ime is the plate dissipation exceeded with operation of the shift control. If he negative grid bias is reduced to a ow value, the current flowing in the plate circuit rises to a high value, but most of the voltage drop appears across the load resistor. (See Figure 4.)

At 35 mA standing current, the power dissipated in the load is 3.7 watts, but at 70 mA it rises to 14.7 watts. Therefore a 20-watt resistor is recommended in or- der to avoid excessive temperature rise.

Apart from the 9-watt plate dissipation limit on the 6CK6, there is a limit of 2

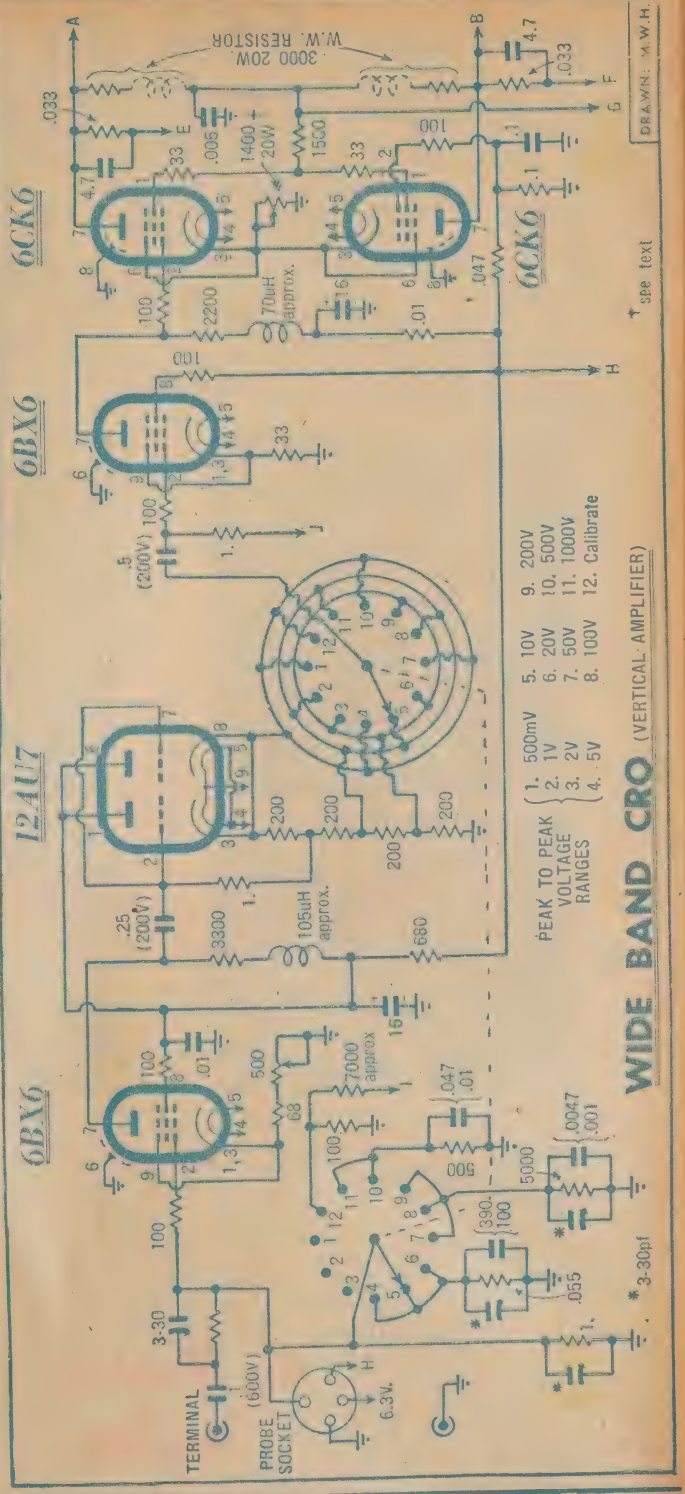

Figure 2. Circuit of the vertical amplifier. Some errors and omissions in diagram published in the February issue have been corrected.

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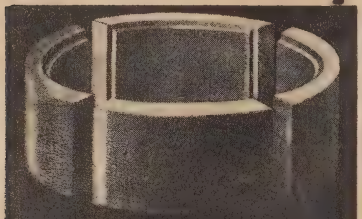

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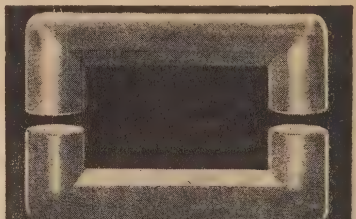

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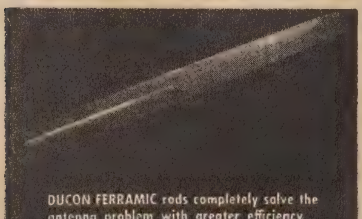

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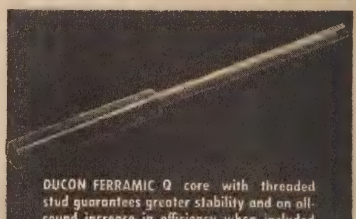

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ts on the average screen dissipation. en the plate voltage drops as the grid s is reduced, the screen current, and ce dissipation, increases. Reading screen and plate curves together for ditions where the spot is deflected the edge of the graticule, the screen ipation works out at about 2.25 watts. This is beyond the manufacturer's ximum rating but would probably not e the temperature of the screen suffintly to release residual gas, since the te, under the same condition, is dissiing relatively little power.

IIFT CONTROL

The vertical shift control should alys be set so that the beam is positioned newhere near the centre of the screen der static conditions. Under dynamic ditions, the average increase in screen rrent is not normally sufficient to ise excessive screen temperature rise. ie common series screen resistor we ve included offers some, although not mplete, protection.

The values included in the circuit diam give a greater range of shift conol than is actually required. We adopt is approach in order to cover tolerces in component values. However, it ould be well worth while including

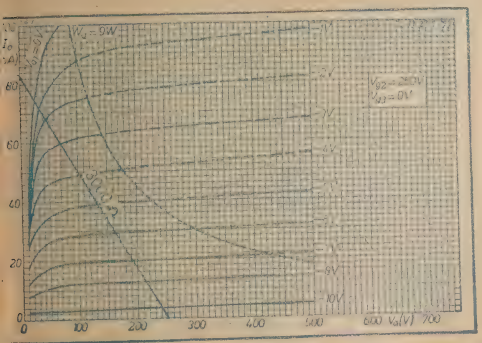

Figure 4: Plate curves for the 6CK6 with 3,000 ohm load line show that plate dissipation is not exceeded, regardless of bias applied to valve.

xtra resistors at either or both ends of ne vertical shift potentiometer in order o limit the shift range to about 1½in ither side of the centre line.

The effect on the time constant of the hift control will be small, since the 1.0 neg grid return resistor makes up most f the circuit resistance.

The grid of the lower of the two alves in the long tailed pair arrangenent is held at a steady potential for lternating currents. However, the athode is connected to the cathode of he upper valve and receives drive beause of the alternating voltage developed cross the common cathode resistor

'LONG TAILED PAIR"

If the lower valve were not present, he upper valve would behave as a cathode follower with a high degree of degeneration. The out-of-phase plate current of the lower of the two valves tends to cancel the current of the upper, with the result that there is only a small residual AC component across the common cathode resistor.

Effective drive applied to the two valves in the output circuit will not be equal, but the balance will improve as the value of the common cathode resistor

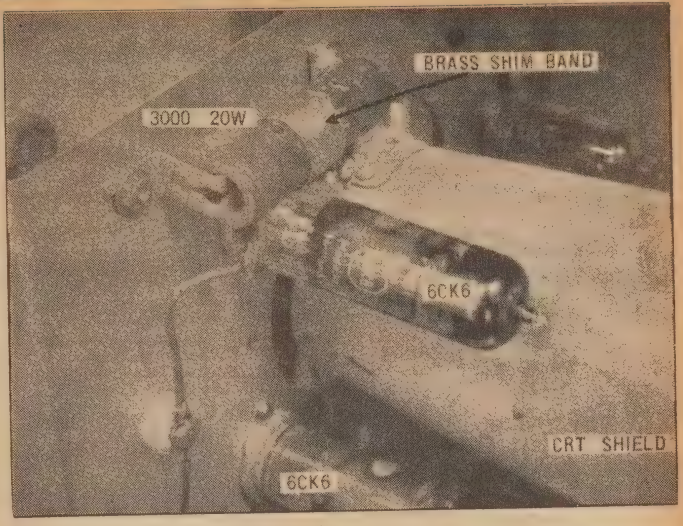

Figure 3: A close-up photograph shows the mounting for the 6CK6 load resistor and the shim metal band for reducing self inductance.

increases. Unfortunately a high value makes necessary a greater high tension voltage and a compromise must be found. The final value is decided bearing in mind that precise balance is not required, due to the push-pull action of the deflector plates.

Stopping resistors are included where necessary in order to obviate the possibility of spurious oscillation. Values are lower than is conventional for class A audio amplifiers, because the input capacitance of the valve plus the resistor form a frequency selective circuit. Higher resistor values could have an appreciable effect on the overall performance of the amplifier.

Drive for the upper 6CK6 is obtained from the plate of a 6BX6, the DC con-

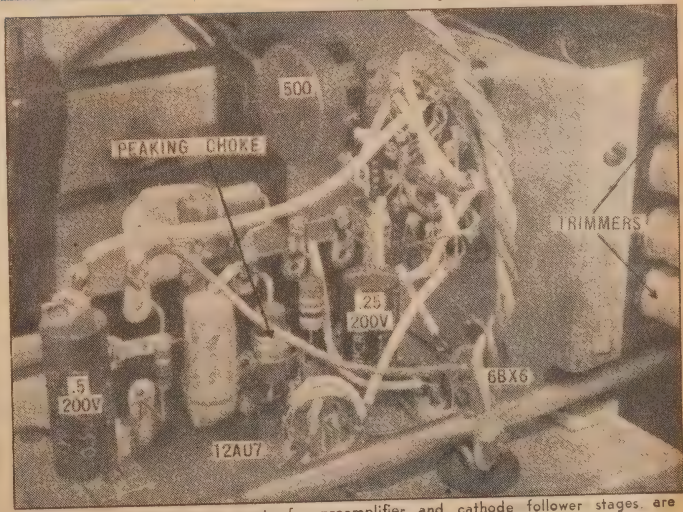

Figure 5: Wiring components for preamplifier and cathode follower stages are mounted on a vertical tag strip alongside valve sockets. Valves are under chassis.

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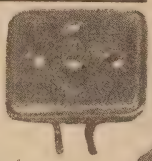

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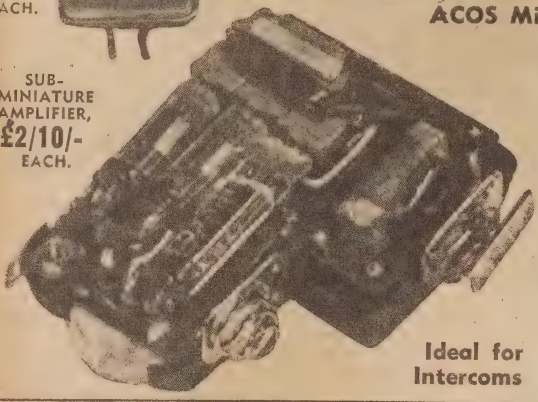

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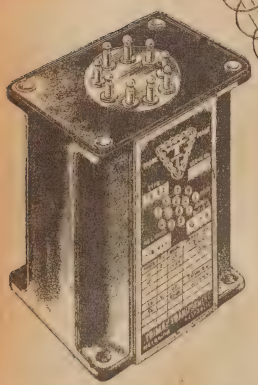

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ction between the two valves being served. The plates of the 6CK6s are ectly coupled to the deflector plates the CRT so that a balanced shift is tained simply by varying the bias on 6BX6.

As was mentioned in the earlier article, elimination of the coupling capaci- s has the advantage of making it sier to obtain an extended low fre- ency response. At the same time some vantage is gained at the high frequency d since the stray capacitance to earth the necessarily large capacitors, other- se required, is no longer present.

OT ALWAYS PRACTICAL

Although by no means impossible, it not always a proposition to provide rect coupling throughout the amplifier cause of the difficulties of establish- g the correct DC levels and the slow ift errors to which DC amplifiers are bject.

In our case, it is merely necessary to ovide an astigmatism control to set the d anode of the CRT at the average ltage of the 6CK6 plates. With the lues given, correct bias on the 6BX6 assured when the shift control is ad- sted so that the spot appears at the ntre of the screen.

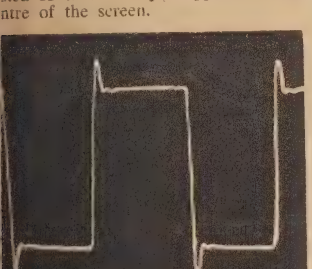

Figure 7: Serious overshoot on fast transient caused by too large a value of peaking inductor.

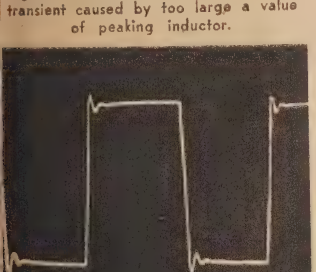

Figure 8: About the optimum adjustment. Input square wave frequency is 300 Kc/s and rise time approx .04 uSec for usual transient overshoot is negligible.

With this shift system, overload oc- urs at the edge of the screen or there- abouts, regardless of the amplitude of he AC component of the signal. At irst encounter, the behavior of the in- trument may seem a little strange to readers who are accustomed to oscillo- scopes in which the shift bias is applied direct to the deflector plates and RC coupling used for the output stage.

This is of little moment since, ob- viously, we are not interested in ob-

COMPONENTS BEHIND FRONT PANEL

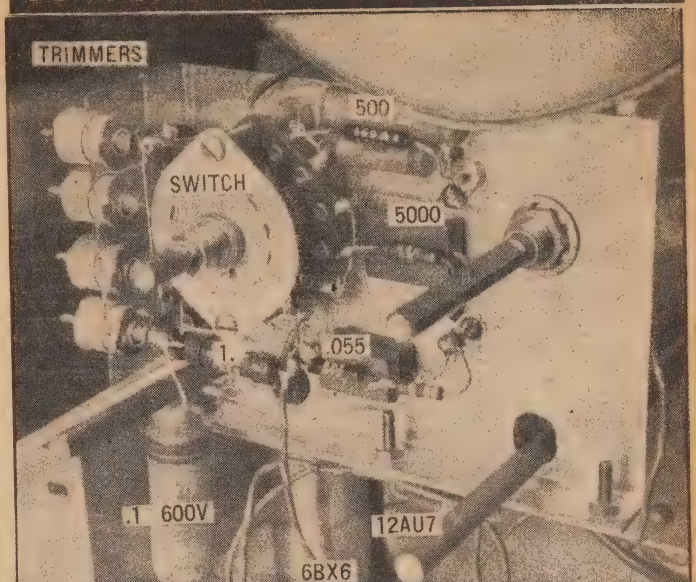

Figure 6: View of input attenuator with front panel removed. Adjustment procedure described in the article should be carried out carefully before panel is permanently mounted.

serving an undistorted pattern which is off the edge of the screen.

When the spot is at the centre of the screen, there will be about 100 volts between the 6BX6 plate and ground and about 50 volts drop across the total plate load resistance.

At very low frequencies the effective load resistance is about 12,000 ohms, while at medium and high frequencies it is 2200 ohms. This arrangement closely compensates for the attenuation at very low frequencies due to the coupling capacitors earlier in the amplifier and the .01 meg/16 uF combination is chosen specifically to give the best results.

The value of 2200 ohms for the 6BX6 load resistor was chosen with the same factors in mind as in the case of the output load resistors. Total shunt capacitance to earth is made up of the output capacitance of the 6BX6, the input capacitance of the 6CK6 plus strays due to wiring and sockets.

It is good practice to stagger the upper

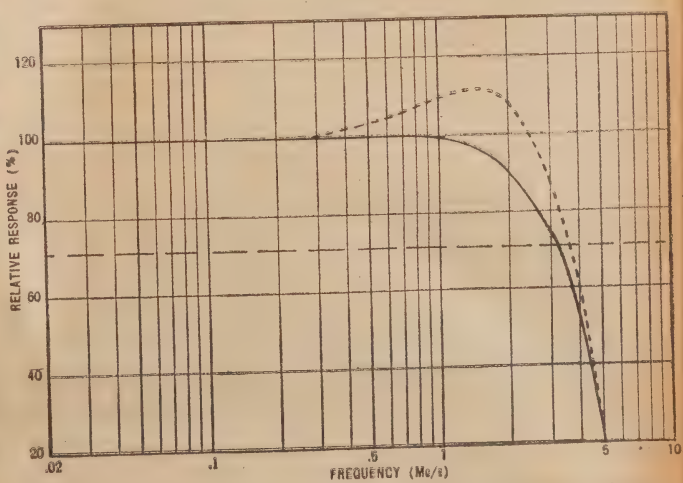

Figure 9: Solid curve shows frequency response of the complete oscilloscope. Broken curve is obtained with too large a value for peaking inductor and corresponds with performance of Figure 7.

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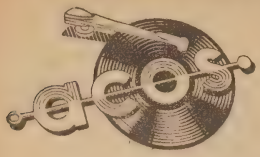

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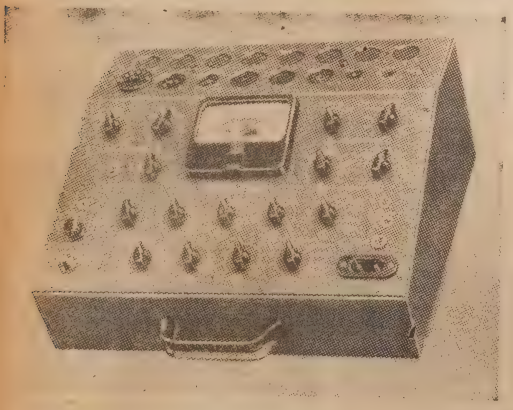

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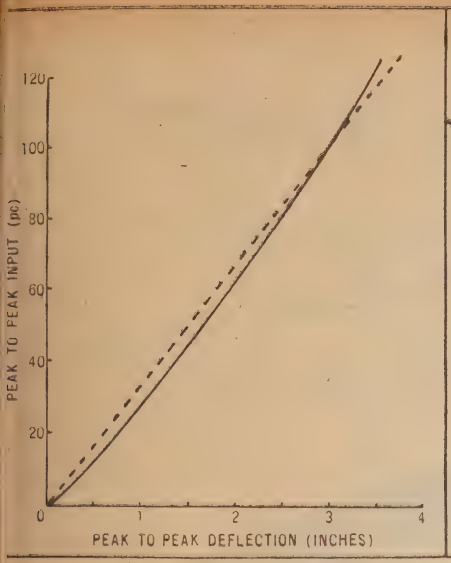


Figure 10: There is an almost linear relationship between deflection and input voltage but a slight improvement in accuracy will result if calibration is carried out at about 2½in deflection rather than the full scale 3in.

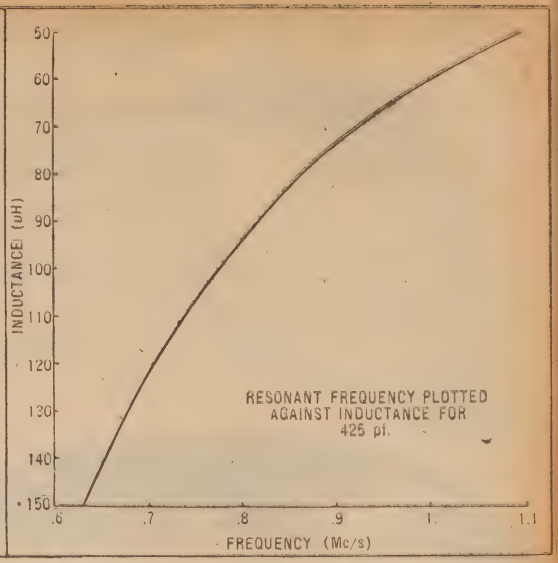


Figure 11: Inductance of the peaking coils can be determined by noting the frequency at which they resonate with a fixed capacitor, if no more direct means are available. Padder capacitors intended for broadcast receivers (425 hF) are frequently available with a tolerance of 5pc or 2½pc.

3db frequencies of the compensated stages making it higher toward the front of the amplifier. With the 2200 ohm resistor plus the appropriate compensating inductor the response should be 1db down at about 3.7 Mc.

Distortion at the plate of the 6BX6 with increasing amplitude does not become evident until the 6CK6s are seriously overloaded and the pattern deflected well beyond the limits of the screen, so that there is an adequate reserve.

CIRCUIT DETAILS

Preceding the 6BX6 is a 12AU7 connected as a cathode follower with the two triode sections in parallel. Rather than a voltage gain, this stage actually gives a slight loss and its purpose is to act as an impedance transformer.

While the impedance looking into the grid of the cathode follower is high, the output impedance is low. In other words, if the stage is considered in terms of the equivalent generator with series internal resistance circuit, the value of the resistance will be low. This, in turn, means that the effect of stray and valve capacitances in parallel with the ouput load resistance will be small.

LOW IMPEDANCE

In our case it is about 250 ohms and therefore can be ignored within the frequency range of this instrument, even when the stray capacitances due to the attenuator switch, the coupling capacitor and the long lead from the coupling capacitor back to the grid of the 6BX6 on the vertical chassis are considered.

Voltage division by 1, 2 and 4 is provided by the resistor chain in the 12AU7 cathode, the required tap being selected by means of the second section of the range switch. The first section of the switch selects divisions in the ratio of 10 to 1 and, combined as shown, gives ranges in the series 1, 2, 5, 10, etc.

The load resistor for the 6BX6 preceding the cathode follower is chosen, bearing in mind the same factors as for the two previous cases. Stray capacitances are lower than before and the effective input capacitance of the 12AU7 is low. The complete compensated amplifier should have a -3db point just under 4 Mc/s. There is a considerable amplitude reserve.

Gain of the stage is controlled by means of a potentiometer in the cathode circuit with an appropriate series resistor in order to limit the maximum current. This potentiometer may be used as a fine amplitude control in order to permit the amplitudes intermediate between those available with the switched attenuator.

CALIBRATION

In practice, this is rarely necessary and the control is set to calibrate the amplifier, i.e., to set the gain so that the peak-to-peak deflections as read against the graticule correspond with the input.

With the value shown, the range of control may be too great, making the control too critical for some tastes. In

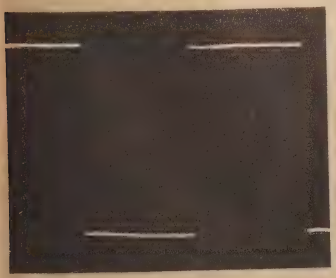


Figure 12: Correct adjustment of the trimmer capacitor across the input 1 megohm resistor.

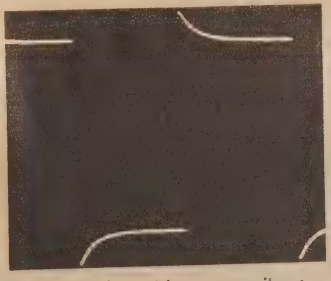


Figure 13: Input trimmer capacitance too high.

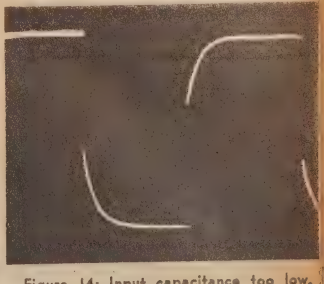
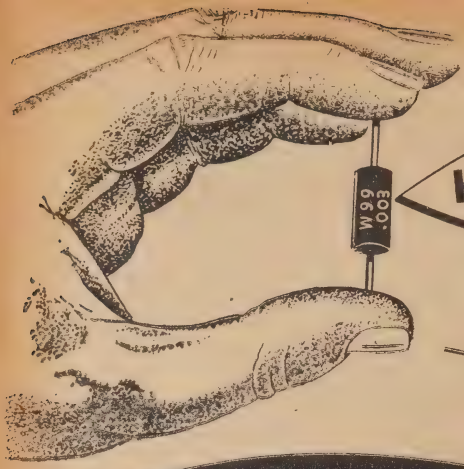


Figure 14: Input capacitance too low. These photographs with 3 Kc/s input.



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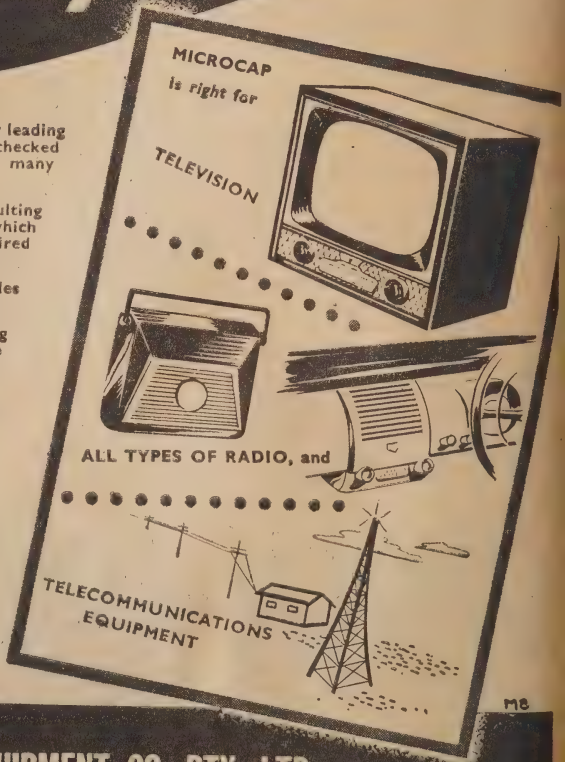

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case it would be a simple matter re a resistor in parallel with the tiometer.

e calibrating signal is obtained from lament winding of the power trans-er. With the mains at 240 volts, esistors should be adjusted so that mV peak-to-peak appears at the of the valve with the range switch e "Calibrate" position. Obviously, accuracy of subsequent recalibra- will depend on the mains voltage nder the worst conditions the error t likely to be greater than 10 pc. r most television test applications will be plenty good enough, while pecial tests you can always monitor mains with an ordinary AC volt-r.

RIOUS RESPONSES

ice the oscilloscope has an extreme-od low frequency response, the ef- of disturbances on the power mains be very serious. Spurious deflec- due to mains pulses are reduced point where they will be notice- only in extreme cases, by the in- on of a voltage regulator tube con- ng the voltage amplifier stages. The ator also helps to minimise changes ain with changes in supply voltage.

curve of deflection plotted against t is given here (Figure 8) and shows the characteristic is reasonably linear n the limits of the graticule (3 inches) aken as full deflection. The differ- between the full and broken line ates that the error due to non- arity based on calibration at 3 inch -to-peak deflection is about 5 pc.

his could be halved by calibrating at nches deflection and would involve tional marks on the graticule as well modification to the values of the re- rs in the divided network from the ent winding. Unless you are par- arly concerned with accuracy, we est calibration at 3 inches deflection rder to avoid possible confusion.

he capacitively compensated attenua- in the input gives ratios of 2 to 1, o 1, 200 to 1 and 2000 to 1, making overall peak-to-peak ranges from 500 up to 1000 volts.

W LEVEL TESTS

n the 500 mV range, sensitivity is cient to enable the instrument to be for the investigation of weak signal litions and hum. In few instances ld a greater sensitivity be desirable a more sensitive design could easily to difficulties with microphony and in the oscilloscope itself.

n the few cases where ranges greater n 1000 volts peak-to-peak are required ecial set-up would be needed in any .

he DC component of the input signal uld not exceed about 500 volts unless ecial capacitor is included in the in- circuit.

he resistive component of the input edance is not less than 1.0 megohm increases on the lower ranges. This unted by a capacitance of the order 20 pF, the actual value varying with range, the .1 uF capacitor and the of input terminal.

here are many critical circuits which edances of this order will disturb reciably and, therefore, provision is le for the connection of an external be.

The probe should be plugged in only when it is required, since its connection upsets the adjustments of the compensated divider. Practical information on a suitable probe will be given in a later issue.

A practical point to bear in mind when wiring the trimmers in the attenuator is that moving plate which is nearest the case when the instrument is installed should be connected to ground (Figure 5). The moving plate of the input trimmer capacitor should go to the .1 uF isolating capacitor rather than the grid of the 6BX6. The object of these precautions is to prevent disturbances to the optimum adjustment of the capacitors when the instrument is installed in the metal case.

CIRCUIT VOLTAGES

The following table gives a number of test points and the corresponding voltages. Allowance should be made for component tolerances and also loading of voltmeter in some cases The bias applied to the output valves, for example, is not -10 volts as would appear from the table

An Avo Model , internal resistance 500 ohm/V FSD, switched to the lowest possible range, was used for the tests.

The controls of the instrument were set as follows: Intensity: spot just visible, Focus: sharpest possible spot, Shift controls: to place spot in centre of screen, Coarse frequency: to "Amp", Fine frequency: at minimum Sync. selector: to external Sync amplitude: to minimum, Vertical range: to 1000V.

VERTICAL AMPLIFIER
- 6CK6: Plates 240V, Screens 340V, Cathodes 105V
- 6BX6 Driver: Plate 95V, Screen 150, Cathode 1.8V
- 12AU7: Plate 135V, Cathode 9.8V
- 6BX6 Preamplifier: Plate 102V

TIME BASE
- 6BX6: Plate 165V, Screen 160V, Cathode 2.8V
- 12AU7: Plates (6) 310V, (1) 190V, Cathodes (8) 195V (3), 6.0V

POWER SUPPLY
- 5V4-G: Cathode 365V
- OD3: 150V
- Transformer centre tap: -7.5V, depending on exact choke resistance. High tension current should be about 150 mA total.

We had planned to include a detailed description of the adjustment procedure for the vertical amplifier in this issue, but space requirements have made this impossible. It will now appear in the May isue.

For correct performance, the self inductance of the output load resistors has to be reduced, peaking inductors of the corect value placed in the plate circuits of both 6BX6's and the trimmer capacitors in the input attenuator adjusted. There is also a variable resistor in the cathode circuit of the 6CK6's which must be set.

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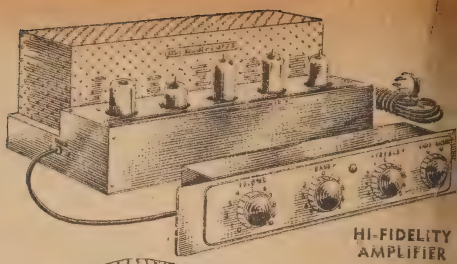

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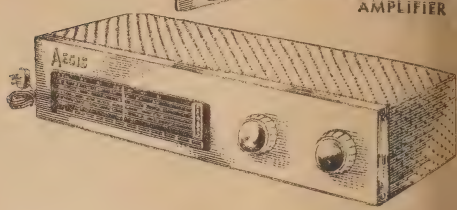

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AEGIS Mullard "5-10" HIGH-FIDELITY AMPLIFIER (featured at the top of this page) has been designed to suit Australian conditions. Rated power output 10W. Max. 12-13W. Frequency response plus or minus 0.5 db, 10 c/s to 20,000 c/s. Alternative impedances available. Amplifier 11¼in x 6¾in. Control Panel: 12in x 3in x 1¾in. It retails at £55/4/- Write for leaflet.

AEGIS HIGH-FIDELITY TUNER (also illustrated above) combines newest circuit techniques and miniaturisation of components. I.F. Stage has band width nearly double that or ordinary receivers. This feature combined with any good treble boost of an amplifier (preferably the AEGIS Mullard "5-10") will give the desired response from broadcasting stations. Finished in permanent SATIN-GOLD colour. Retails at £35 Write for leaflet.

AEGIS MFG. CO. PTY. LTD., 208 LITTLE LONSDALE STREET, MELBOURNE.

PHONE: FB3731. ASK AT YOUR DEALER'S FOR PRODUCTS BEARING THE AEGIS BRAND

A READER BUILT IT!

Gadgets and circuits which we have not actually tried out, but published for the general interest of beginners and experimenters.

'ERSION OF R. T. & H. TUNER USES SERIES TUNING

A reader from Victoria has an interesting suggestion to make about the RT & H Television Tuner, described in the February 1957 issue It involves the use of series-tuning to offset possible problems with long leads.

'HE layout of the original tuner was actually such that lead lengths did t cause any particular difficulties and verage could have extended beyond hannel 9, had it been so desired.

This particular reader says that he odied our original article with a good al of interest, and within a few days d knocked together what he refers to a "Chinese" copy. However, because variation in layout and switching, he und himself in trouble with lead ngths and unable to cover Channel 9. e says:—

"After considering the problem, I de- ded to try a method I have used suc- ssfully in my mobile 2-metre transmit- r, and, as the results were so good, I lt it would be worthwhile to pass them) to you for experiment.

"The answer to my problem was ser- s tuning, and I found it was possible) peak up the tuner with no more ouble than a broadcast receiver. Switch ld lead lengths are no longer a prob- m."

:OIL DATA

Our correspondent says that using a -turn coil, close wound with 20-gauge ire, and with a 1½-inch lead both ends. was possible to tune to 270Mc—the mit of his grid dip meter. In this par- cular tuner, leads of this length were ecessary to stretch from the switch con- ict to the trimmer, which was mounted bove the chassis.

On Channel 2 it was necessary to ind about 30 turns on the shank of a umber 20 drill (20 gauge wire) to hit 3Mc with a Philips trimmer almost ompletely in mesh. With the trimmer ut of mesh, the coil will reach 160Mc.

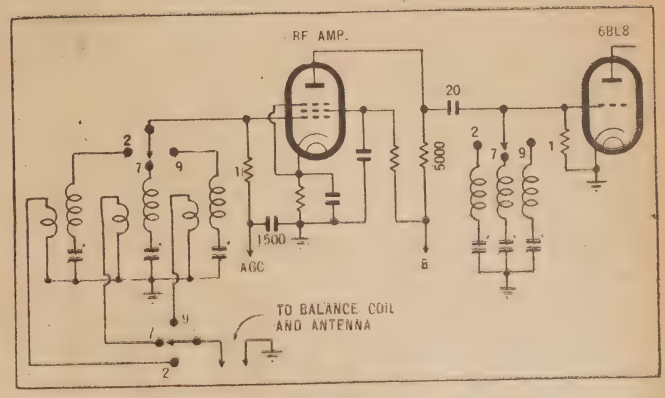
Says our correspondent:—

"It seems to me that, where you are atering for the general constructor, this vould be a decided advantage, due to the ion-critical nature of everything.

"My only worry is where to put the rimmers, so I have just put in three hannels for the moment. Also it might e possible to use cheap mica trimmers, lthough I haven't tried them."

Even more promising than the Philips r compression mica trimmers suggested y our correspondent, would be the con- entric screw type ceramics, which have ecently become available. These have an adequate capacitance range, are relatively small and extend inwards from their single-hole mounting.

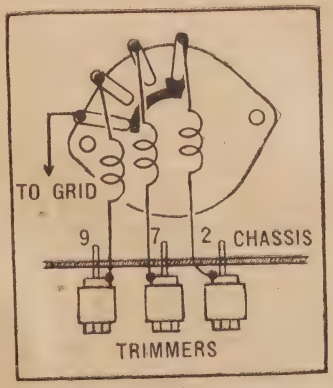
The "catch" in a series-tuned system is that the series-tuning capacitor and the net circuit capacitances at the other end of the coil from a divider circuit across which the signal potential appears



This circuit shows the modifications made to the RT & H Television Tuner, described originally in the February 1957 issue. Trimmers are 3-30 pf Phillips.

If the series-tuning capacitor is smaller than other capacitances lumped together, then only a fraction of the total signal voltage will be impressed on the valve grid.

To a degree, the effective "tapping down" of grid and plate circuits is compensated by their reduced loading on the tuned circuit. If carried to extremes, however, in an effort to offset grossly unsuitable layout, only a very small proportion of the total signal voltage is available between grid and chassis.



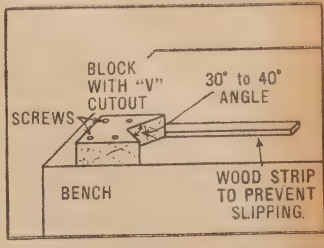
Wiring of a typical switch bank. Note that coils run straight between contacts and trimmer connections. Channel 2 coils are 30 turns 20g. close wound on No. 20 drill; Channels 7, 9 are 5 turns 20g. close wound on ¼in. drill. Antenna coupling is one turn for Channels 7 & 9, two turns for Channel

---

A SIMPLE wood stop to hold timber which is to be planed on the edges can be made as shown.

Taking a block of medium hardwood, approximately 2in in thickness cut a "V" into one end to an angle of 30 to 40 degrees. Mount this on the bench with wood screws.

Tack a ½ inch, thick strip of timber along the edge of the block to prevent the timber slipping across the bench.—**J.T., Taree, NSW.**



Here's your answer, Tom!

The radio hobby is full of problems which "stump" the beginner and keep him guessing for weeks on end. Some of this month's queries may seem very elementary to many of us but, casting our minds back, we will realise that similar problems plagued us when we were just starting out in radio.

SOME of these questions we may have answered before in these or in other columns, but that doesn't mean that all beginners have read them.

★ ★ ★

I have a pair of low impedance headphones which I have been using with a crystal set with very good results. Recently I built a one-valve set and on connecting the same pair of headphones the results were very poor. One of my friends lent me a pair of high impedance phones, which improved the performance considerably. Could you please explain the reason?

It is usually accepted that high impedance — 2000 or 4000 ohm — phones are the best choice for a crystal set, but good results may be obtained with low impedance types.

A point in their favor is that many of the low impedance types are very efficient and by adjusting the tappings on the coil in your set some degree of matching may be achieved.

Impedance matching in a valve receiver, on the other hand, would entail the use of a suitable matching transformer, and fiddling with the coil, etc., cannot improve matters as far as the headphones are concerned.

Since the load requirements of valves are generally fairly high the high impedance phones are a closer approach to the correct load. This accounts for the improved performance that you describe.

★ ★ ★

I wish to amplify a crystal set. How could I go about doing this?

To amplify the signals picked up by a crystal set, Tom, it is necessary to use an audio amplifier, which may be a valve amplifier, or, if you want the latest, a transistor amplifier. Circuit designs of both have been featured in past issues of this magazine and reprints are available through our query service.

Briefly, the valve amplifier usually consists of an audio transformer with a high step-up ratio, feeding into a valve connected as an audio amplifier.

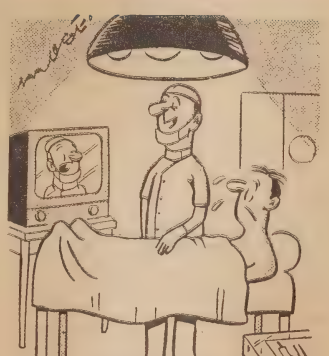
Weak signals from the detector are stepped up by the audio transformer and fed to the valve which provides further amplification. The amplified signal finally appears across the headphones, which are connected in the plate circuit of the valve. Appropriate operating voltages for the valve must be provided and it is customary to use batteries for the purpose.

Some circuits use a high gain valve and the audio transformer is dispensed with. Some means of varying the volume of the signals is usually provided and takes the form of a potentiometer in the grid circuit of the valve.

★ ★ ★

I have noticed that commercial circuits specify capacitors of about 50 pf connected across both windings of the IF transformers. Why is it that R, TV and H circuits do not specify any such capacitors?

In trying to keep our circuits simple we do not show capacitors across the IF



Now take up the scapel—that's the small short-pointed instrument

windings, nor do we always indicate the presence of iron slugs—variable or otherwise. It is not really necessary to show these on circuit diagrams since they are an integral part of the transformers.

It may be confusing to some readers, but were we to show them there would be just as many others who would be found wiring them in across the transformer terminals.

In actual fact, Tom, ordinary IF transformers have capacitors of between 50 and 150 pf connected across each winding, the exact value depending upon the design and purpose of the transformer.

In the older types the inductance was fixed and the capacitor was made variable to enable one to tune the windings to exactly the specified frequency.

In modern types the inductance may be varied by means of adjustable co allowing fixed capacitors to be us Tuning of the windings to the corr frequency is accomplished by the adju ment of these cores. The capacitors u are small mica types and are quite f quently moulded into the base.

In either case these capacitors are p and parcel of the transformer and not have to be added as an extra co ponent.

★ ★ ★

Looking through an ARRL handbook I noticed some transmitter circuits for the "novice" which at the time puzzled me. Later I was looking through a QST magazine and saw some notes on a "novice" round-up, with photographs of the novices, who were between the ages of 7 to 17 and all of whom owned transmitters. I am 14 and have been waiting for the day when I would become an amateur, but since reading about the novices I wish to know whether such conditions exist in Australia.

We shall have to disappoint you, To because the PMG's Department in A tralia does not issue novice licences. Y will have to wait till you reach minimum age of 16 before you c qualify for a licence—after passing requisite examination.

One consolation that we can offer that the regulations now permit amateur station licence to be grant without an examination in Morse co assuming that the candidate can pass theory and regulation papers satisfa torily.

Licences granted on this basis limit operation on amateur bands to 144 and upward. The licencee may exte his activities to the lower bands simp by passing the Morse exam.

If you are serious about your futu amateur activities we suggest that y obtain a pamphlet from the PMG Department, describing the conditio under which amateur licences are issue We also suggest a series of articles the subject, published in this magazi commencing in the August, 1954, iss and available through our query se vice.

★ ★ ★

I wish to use a 385 volt 100 mA transformer in a circuit requiring a 285 volt 40 mA transformer, also a 100 mA choke in place of a 40 mA one. Can you suggest a method of reducing the ratings of these components to the recommended values?

Technical "long-hairs" may smile

e, Tom, but don't be put off by ecause we can assure you that uestions crop up quite frequently.

100 mA rating as applied to a rmer indicates that it has been d to deliver a maximum current mA without overloading. There bjection to using this transformer load of only 40 mA. The only complication is that the trans- may deliver a trifle higher vol- nder light loading, but this is only nd order effect.

voltage rating, on the other hand, different story and, short of re- the number of turns on the ary, there is nothing one can do decreasing the voltage.

you have 100 volts too many from ansformer, there will be at least nany in excess of the DC require- This would make it very diffi- r the valves and other components set.

RECT VOLTAGE

obtain the correct operating voltage necessary to insert a heavy duty r somewhere in the filter system. value of this resistor may be cal- d from Ohm's Law. In your case necessary to drop 100 volts at cur- drain of 40 mA, the resistor will to be 2500 ohms and capable of ating five watts without overheat-

better scheme is to connect the ping resistor between the output of ectifier and the junction of the HT and first filter capacitor. This will e the peak current demands on the ary of the transformer, and make ry much easier for the rectifier and first filter capacitor. A value of t 2000 ohms should be quite ade- e in this case.

ne current rating of the choke pre- s no special problem, and there is bjection to using a 100 mA choke lace of the one specified. The 100 rating indicates that the choke is ble of carrying a total current of to 100 mA. If substantially more 100 mA is passed through it, the ce will tend to heat up, and, in eme cases, become open circuited.

RGE SATURATION

t the same time the excessive cur- will tend to saturate the core, eby decreasing the inductance of the ke, and consequently the filtering ct of the choke, to a value much er than it is supposed to be.

Conversely, if less than 100 mA is sed through the choke, the inductance filtering efficiency will tend to rise, ch is all to the good. There will less heating and consequently less nce of the choke burning out.

o if you have these components on id and have space available, go ahead l use them, taking care, of course, observe the precautions mentioned ve in relation to the excess voltage. And now for a problem which crops frequently and is the cause of un- ling grief to beginners.

★ ★ ★

What causes motorboating and ow can it be cured?

To those who are not familiar with term it may be described as a regular "plop-plop-plop" effect issuing from the speaker. This effect can generally be traced to unwanted coupling between stages via the common power supply.

When the receiver or amplifier is switched on some random impulse reaches the grid of the output valve. Since this valve cannot differentiate between noise and music it amplifies the impulse and produces a variation in its plate current.

Almost all power supplies are sensitive to variations in the current drain so that the impulse to the output valve is reflected as a tiny variation of the high tension voltage.

This variation is, in turn, felt by the valve or valves in the preceeding stages and they amplify it and feed it back to the output valve. The output valve then proceeds to produce a bigger and better impulse and if conditions are favorable the whole amplifier bursts into oscillation.

The frequency of oscillation or the rate of the "plop-plop" sound will be quite low, due to the high values of inductance and capacity in the power supply.

It would be far too expensive to design a power supply completely insensitive to current changes, although some measures are taken to minimise the effect. For example, filter capacitors are made as large as is permissible with the particular design.

Partly run-down batteries exhibit poor regulation and a set which is perfectly stable on fresh batteries may develop motorboating on partially run-down batteries. To prevent this and to extend the useful life of batteries it is customary to connect an 8 mfd electrolytic between the high tension line and earth.

DECOUPLING

The most practical and standard approach to prevent variations in the high tension from affecting earlier stages is to use a "decoupling" circuit.

Instead of running the first audio transformer or the first audio plate resistor directly to the high tension line it is customary to connect a resistor of several thousand ohms in series and to bypass the junction with an 8 mfd capacitor.

Decoupling is most effective when applied to the first stage of the audio amplifier and if there are several stages in all the first two are frequently fed from the same decoupling network.

Trouble is most likely to occur in an amplifier with very high gain, and that is one of the reasons why the audio section of receivers is generally limited to two stages.

In a receiver, motorboating is sometimes produced as a result of interaction between the plate current of the output valve and the screen voltage of the converter or one of the high frequency amplifiers. Here again the usual approach is to provide some form of decoupling.

Finally, motorboating can be caused by some of the RF signal voltage getting into the audio amplifier. It is amplified and re-radiated from the wiring and loudspeaker leads to the aerial circuit. The usual cure for this is to instal a mica bypass capacitor from the plate of the detector or one or more of the audio valves.

TELEVISION TUNER FRAME

As described in Radio & Hobbies for February, 1957. Punched and formed ready for assembly 24 gauge brass **19/6** plus tax and postage.

WIDE BAND OSCILLOSCOPE CASE

Brackets punched and formed ready to assemble as per Radio & Hobbies, February, 1957. No Tube shield. **£15/10/-** plus tax and postage.

5" SCOPE TUBE SHIELD

As per Radio & Hobbies February, 1957. **£3/19/6** plus tax and postage.

TWO INSTRUMENT CASES

Taking all the modern Television equipment as described in Radio & Hobbies with louvres at each end and removeable front, finished in grey lacquer.

MC5A 9" long 5½" deep 6 5/8" high **17/6** plus tax and postage.

MC82A 13" long 6 7/8" deep 8" high **£1/12/3** plus tax and postage

At all wholesalers

or

R. H. OXFORD & SON PTY. LTD.

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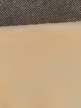
Viewed from one side, we see the four-inch speaker visible through the cabinet cut out, and a first version of the dial scale, marked in both stations and Kilocycles. The volume control knob is at the other side.

The Little General For 1957



Here is a new mantel receiver intended for use in the home for the reception of local broadcast programs. As such it has ample pickup with no external aerial, a dual purpose output valve for higher gain, negative feedback for better quality, a new and simple dial to save space and money, and modest cost price due to few components and exceptionally low current drain. It is also the smallest mantel set we have ever made.

by John Moyle

IN our issue of last month, we talked about a new circuit we had dreamed up for a simple 4-valve broadcast receiver—a circuit intended to be useful for any kind of 4-valver we wanted to make, whether it should be to drive a large speaker in a console cabinet (do we still have such things?) or a baby model as a bedside mantel.

The chassis with which we illustrated the circuit used an ordinary type of edgelit tuning dial and, although it wasn't large, we didn't take very much trouble to keep it small.

WORTHY SUCCESSOR

But the circuit does lend itself to use with a very small set, one which, as mentioned last month, we could consider a very worthy successor to the Little General receivers, the first of which was published about the year 1940.

If you were around and about and building sets in that era, and I'm sure hundreds of you were, you will remember how successful it was. We were forced to bring it out with all kinds of variations. The original circuit, which by the way is still in use, or was until the speaker field coil burnt out a week or two ago, was so simple it didn't even use AVC.

So we added AVC to it, and later on a dual wave bracket, which succeeded mainly because of the perseverence of its constructors and the fact that about that time short-wave stations began to increase their power levels and the efficiency of their aerial systems!

In fact one of our readers of that era, no doubt imbued with the patriotic fervor of the times, wrote vowing to us that "There would always be a Little General", doing it so nicely that we re... believed he hoped there would be!

Even today it's hard to ignore ...claims of our martial midget but, if ... start from scratch again (and after ... these years that mightn't be a bad id... we can improve on it in several wa...

EARLY DESIGN

Because this article deals specifica... with the application of the circuit to ... small set which we have called the 19... Little General, it's a bit hard to av... saying some of the things already s... in last month's issue. But because so... of our readers may not have that iss... handy when they read this one, you m... excuse us if, having visited the bookst... last month, you strike some repetition ... argument.

The two circuits are somewhat simil... up to and including the two first socke... for both use converter valves, an IF ... 455 Kc, and a diode-pentode IF amp... fier. Naturally modern valves are mo... efficient than the older types.

For an aerial, however, the origin... used a length of hook-up wire whi... theoretically was to have been tacke... along the skirting board or the pictu... rail but which, in fact, generally traile... along the floor and frequently got e... tangled in all kinds of things.

There wasn't much else to do about i... for loop aerials and loopsticks weren... available in those days, nor for that mat... ter, were any midget components an... coils.

So we squeezed a pair of standard coil... under the chassis—an aerial and oscilla... tor type—and found room for full-size... IF transformer on top.

LOOPSTICK AERIAL

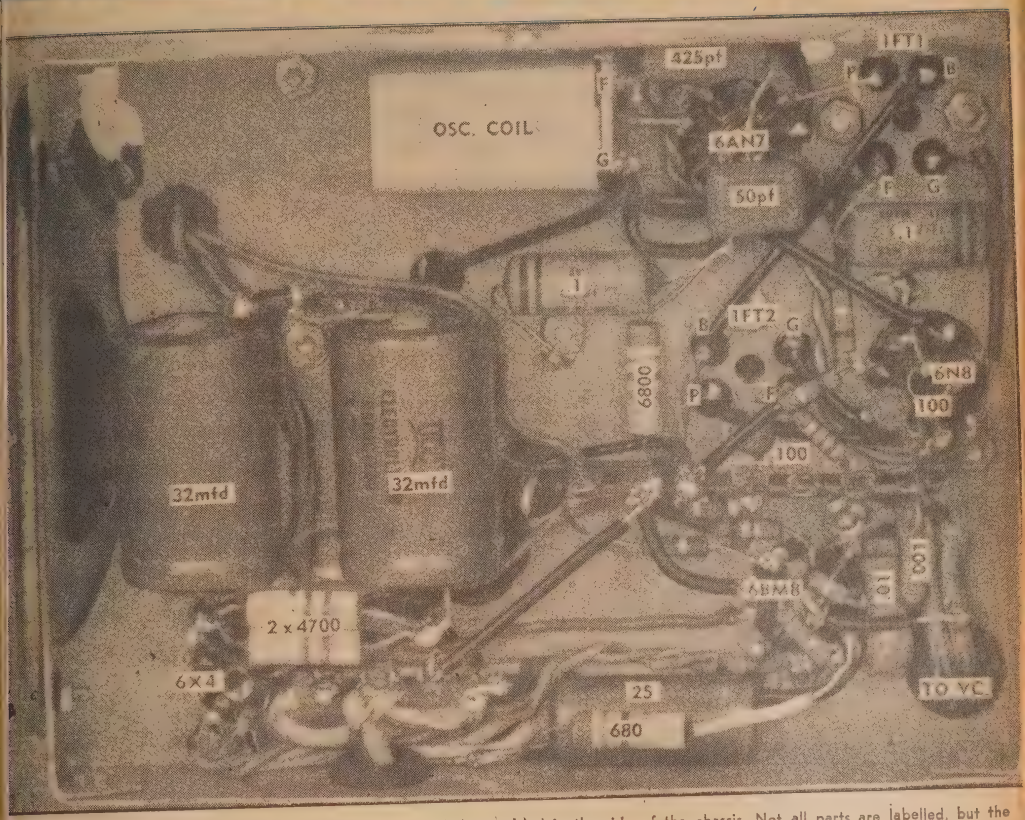
And by the time we had added th... tuning gang, power transformer, speaker... dial drum filter capacitors, there wasn... much room for the outsize tubular con... densers and other components which i... those days were all we had to use.

However, adopting the policy tha... every square inch in the cubic capacity... of the cabinet should be used, it was re... markable how the over-all dimensions... were kept down.

To be sure, the thing got hot. There... was a beautiful hot spot around the rec... tifier which had to spend its life buried... inside the cabinet, and many a duplicate... grew a dark spot on the leatherette jus... above the position of the 5Y3GT.

Today we not *only* have smaller coils...

UNDERCHASSIS PICTURE TO HELP YOU WIRE UP



The iron core of the oscillator coil is adjusted through a hole provided in the side of the chassis. Not all parts are labelled, but the picture being slightly over life size should make almost all of them obvious by inspection. The volume control is mounted to the side of the cabinet above the top chassis line.

ceiver, and by that we mean the smallest and neatest set which we are likely to use around the home.

To assess the position, we should remember that the amount of sound we can get today from a given electrical output is very much greater than we could manage 15 years ago.

Speakers in those days, particularly the small types of 6 inches diameter and less, were most inefficient by present standards.

To begin with, they used energised coils which drew power from the receiver, and this was limited because of the moderate voltages and current drains which were practicable.

Their cones, too, were heavier and not as good as those now used.

PERMANENT MAGNETS

Permanent magnet fields, of a type in which the magnetic circuit is arranged to make full use of the flux available, are universal today even in the smallest speaker, so that they make several times as much noise for the same number of watts, or milliwatts.

If we could say that efficiency has gone up four times, that is the same thing as saying that we need only one-quarter of the electrical power for the same output as we did previously.

Without pressing the point any further, we can assume that an undistorted output of about half-a-watt, or even much less, is all we need for a small set which will almost certainly be used within arm's reach of the listener.

POWER OUTPUT

We must remember, too, that no matter how easy it is to dream, we would be dreaming to imagine that a baby set and a baby cabinet can ever give us anything but small-scale listening. High volume with the restricted frequency range we assuredly will get is a tiring thing to have, if not downright uncomfortable.

In the matter of output, therefore, we began from the power supply end, agreeing that if we could get something like a quarter-watt with a low voltage, low-cost power supply, we would have all we wanted.

The smallest and cheapest power transformer currently available has a rating of 150 volts per side at 30 mills, and this was the type we set out to use.

We reckoned that we could get the output we wanted by running the plate of the 6BM8 from the full high tension of such a supply, which, with an indirectly heated rectifier and a large 32 mfd filter condenser would probably be about 160 volts.

In order to keep the current drain of the 6BM8 within our limits, and we didn't plan on more than about 18 mills for it, we estimated a screen voltage of about 130 volts would do. This we obtained by means of a dropping resistor and another 32 mfd filter condenser. The bias resistor was selected to suit, and we ended up with about 10 volts of it.

SUPPLY VOLTAGES

These conditions approximated a scale down from those used with the 250 volt supply of last month's circuit, and allowed a load resistance of about 7000 ohms to serve—a handy and easily obtained value for the small output transformer used with a small speaker.

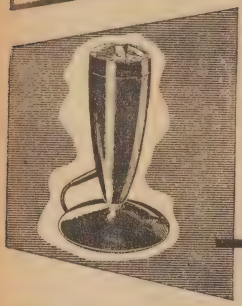
While on the matter of the power supply, we may as well consider the ope

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

FOR EVERY PURPOSE



DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

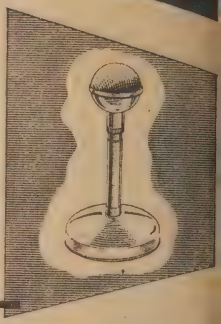
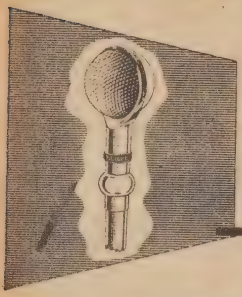


TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**

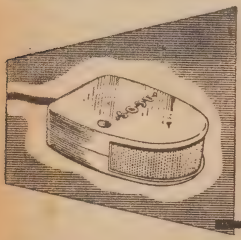


HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise **PRICE, £24/19/6.**

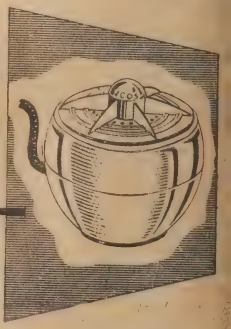
LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6**



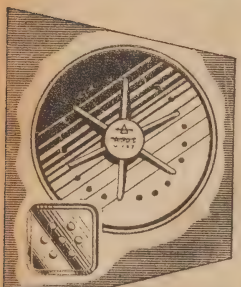
GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**



HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



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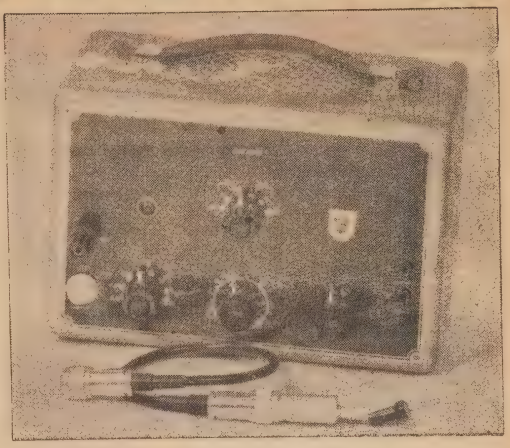
RADE REVIEWS AND RELEASES

JARE-WAVE GENERATOR ROM PHILIPS ELEC. IND.

er the type number GM2324, a square wave erator from Philips Electrical Industries Pty. Ltd. compact instrument with attractive specifi- ons. It is actually a product of the Dutch ps factory and maintains the high standard of kmanship we have come to expect from that organisation.

ARE wave tests are frequently quickest and the most satisfac- ay of determining the perform- wide-band audio amplifiers, video ers, oscilloscope amplifiers, etc. tively compensated attenuators adjusted much more quickly with of a square wave generator than n ordinary signal generator. ng the amplifier tests as an ex- in order to handle a low fre- square wave with small distor- he amplifier must have an ex- low frequency response. There fact, a direct connection between oop of the tail end of a low ncy square wave and the low fre- response of the amplifier.

☆



Square wave generator type GM23-24. Dimensions are approx. 10in by 7in by 5¾in.

IFIER STABILITY

many cases it is important that plifier remain stable when subject arp high amplitude pulses and a square wave generator offers k and certain means of checking aracteristic.

GM2324 generates square waves uencies between 25 c/s and 1 M/cs. eak-to-peak amplitude of the out- n be varied between 0.12 volts and lts.

nost important characteristic for a wave generator is the rise time front of the square wave. Since tal rise time is difficult to define me taken to rise from 10 pc to of the full value is generally

value depends on both the in- resistance of the equivalent gener- nd the capacitive loading. In this the internal resistance varies be- 25 ohms and 330 ohms, resulting times varying between about 0.03 .04 microseconds.

s assumes that the capacitive load ng the end of the terminating cable not exceed 8pF. For greater shunt ities the rise time will increase, the se being greater for the higher t voltages where the internal resist- is higher.

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TAYLOR CRO

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PART 20—AUTOMATIC GAIN CONTROL

Following upon last month's discussion of the DC component, it seems logical in this iss to examine more closely the subject of automatic gain control—generally referred to "AGC" and equivalent to AVC in a broadcast reeciver.

THOUGH perhaps a new term to many readers, automatic gain control (AGC) is merely the counterpart in a TV set of automatic volume control (AVC) in a conventional AM broadcast receiver.

The function of an AVC system, it will be recalled, is progressively to limit the gain of the RF and IF stages with input signals of increasing strength. It tends to keep the level of signal passing through the receiver to manageable proportions and avoids overload of any of the high frequency amplifier stages.

By its very nature, an AVC system compensates automatically for variations in strength of the input signal, whether due to the station selected, to propagation conditions or to effects in and around the receiver.

MINOR ADJUSTMENT

Because the strength of signal available to the detector and audio system is thus held to a fairly uniform level, the "volume control" needs only minor adjustment to maintain the sound output at the required level.

In a television receiver, where sound is only part of the story, it is much more appropriate to describe this same circuit function as "automatic gain control" and to use the abbreviation "AGC".

The purpose of an AGC system in a television receiver is to maintain the input signal to the video detector substantially constant. Some systems achieve this to only a limited degree, but, with good design, it is entirely possible to maintain the level at the video detector within a few percent, with input signals ranging from 20 or 30 microvolts to a fraction of a volt.

The immediate result of such a provision is that the receiver's "Volume" and "Contrast" controls require only minor adjustment when tuning from station to station.

What is no less important, an effective AGC system maintains a constant signal input to the synch. separation stages, simplifying their design requirements and rendering them more reliable in operation.

Obviously enough, AGC is most desirable in areas served by more than one station. In keeping with this remark, many early English receivers did not employ it. Later English receivers, together with all current American and Australian types, include some form of AGC as a matter of course.

by Neville Williams

The requirements of an AGC system in relation to a TV set call for more careful consideration than is usually given to AVC in an AM broadcast receiver. It may be helpful to tabulate and discuss some of the relevant points.

(1) The AGC system must prevent overload at any point in the receiver, except where the design specifically requires that a stage operate with abnormal input.

An immediate example of deliberate "overload" operation is in the FM sound channel where, following usual FM practice, one or more stages may function as "limiting" amplifiers.

Again, the synch. separation circuits may operate under quite abnormal conditions in order to suppress all but the synchronisation pulses.

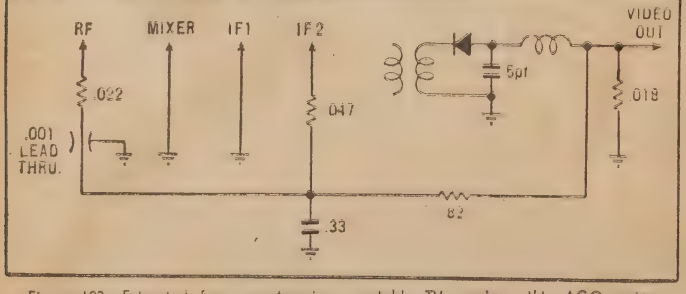

Figure 123: Extracted from an American portable TV receiver, this AGC system represents just about the ultimate in simplicity.

However, accidental overload o stages, intended to operate as linear amplifiers, may lead to a of troubles as under:

(a) Loss of synch. pulses due t ping of signal peaks;

(b) Exaggerated tone values picture;

(c) A negative rather than tive image;

(d) Appearance of sound ene the screen producing spurious ground patterns.

(e) Interference of picture with the sound channel causing effects.

Prevention of overload involves more than the mere application AGC voltage to the grids of R IF amplifier stages, as in a conve broadcast receiver.

Of necessity, the valves used TV set have a high figure of conductance and, generally, a sho base. A single control voltage, through a common AGC line prematurely bias a later stage to to cut-off for the order of signa required to handle .

EARLY STAGES

To avoid this difficulty, it n necessary to proportion the contr age discreetly so that, on large signals, most of the gain reduc effected in the early stages, leavi later stages still able to hand requisite signal level.

The optimum solution to this lem will vary with each basic —the type of RF amplifier and the number of IF amplifier stag the preference for remote or sha off valves.

(2) The AGC system must the level of signal constant any given station.

Failure to meet this requi must inevitably result in random tion of picture contrast with ch signal level. In some receive change in signal level will also on the bias level of the video an and picture tube and change brightness as well as contrast. greatly complicates control of t ceiver, particularly for non-te persons.

In addition, there is a dange inadequate control will allow the level to vary sufficiently to pr the operation of the synch. sepa circuits. This may cause compl partial loss of synchronisation inadequate or poorly adjusted tion systems.

ept at extreme range, television are not subject to atmospheric in the manner of signals on the m-wave broadcast band.

wever, variations of signal level eadily occur due to reflections noving objects in the signal path. es on a nearby street or aircraft in the vicinity can produce fluc- is in signal strength at anything a very slow rate to a "flutter" ncy approaching 50 cps.

ateur station operators will often noticed this effect registered on "S" meters, particularly on the 1 144Mc bands.

v-speed variations in signal h pose no particular problem, than to require that the receiver adequate initial gain and an ute contol characteristic over that

CONSTANT

h speed variations are a different , because ability to cancel them for an AGC system having a onstant much shorter than usual , in fact, to follow a flutter at les or thereabouts.

l, is a very difficult requirement sfy in any simple system, partly e of the component values re- .

re important is the fact that a AGC system, having a short onstant, tends to act as an in- ng network and to generate extra l voltage during each frame group.

h can mean, in turn, that the am- of synch. pulses during the frame would be reduced and operation frame synch. circuits may be ced.

ddition to the above propagation t swaying of the aerial, flapping of e and even movement of nearby in the wind, can produce quite kl and yet quite random changes mate signal strength at the aerial nals.

h AGC system should be able to tall such effects.

) The AGC system should ideal- eact only to the synch. pulse s of the input signal.

o any given station, the carrier e radiated on pulse peaks is con- t. Between peaks, the energy level signal is likely to vary in quite n fashion with picture content.

TIRE FLUCTUATES

e AGC system is influenced more th average energy content of the than by the carrier amplitude on the gain of the receiver will tend tuate with picture content, affect- ntrast and, in some cases, bright- vel.

relationship between picture con- nergy level and the DC resultant xplained at some length in last nth's article.)

) The AGC system should not arily be affected by noise im- ulses.

n the frequencies used for televi- ervices, atmospheric noise is not immediate problem, and it is pos- e to view and listen through con- ns which would produce quite hope- atic on the medium wave broad- and.

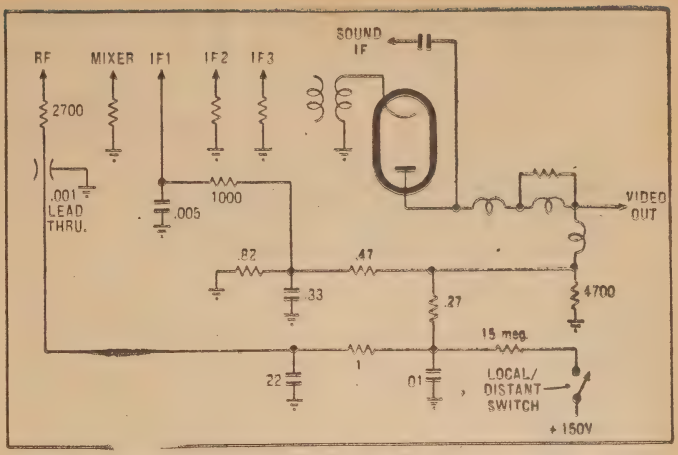

Figure 124: More complex than figure 123, this AGC system is still essentially a simple arrangement. Note the use of a "local-distant" switch to cancel any initial bias on the controlled valves with weak input signals.

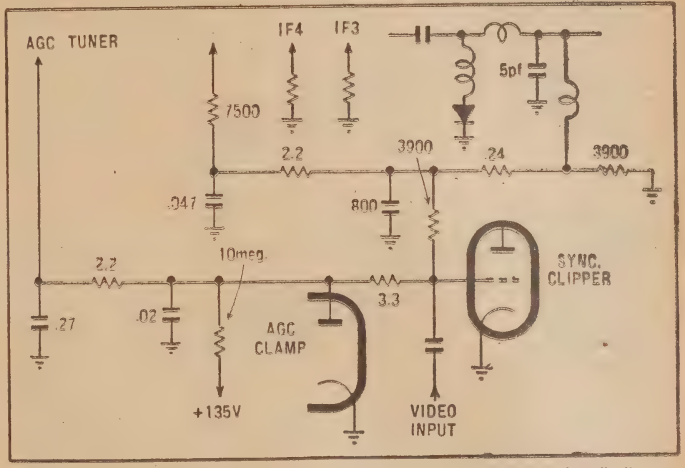

Figure 125: This AGC circuit contains two noteworthy provisions—a "clamp" diode to replace the "local-distant" switch illustrated above and the use of extra voltage from the synch. clipper to augment that from the video detector.

Conversely, however, ignition and other electrical interference can be a serious problem at VHF, particularly where the equipment is operated near to a busy highway.

Although such interference may not readily penetrate the FM sound channel, it can readily produce dark streaks across the picture.

Unless very serious, these latter can be ignored. However, if the energy level and duration of the interference is high, it may increase the AGC voltage, lower the gain and reduce momentarily the strength of the incoming signal. If the noise reacts simultaneously on the sweep circuits, loss of synchronisation may result and this certainly cannot be ignored.

(5) The AGC system should ideally operate only on signals which are above a certain minimum strength.

By so delaying the action of the AGC circuit, the full gain of the high frequency amplifier stages is retained for very weak signals.

Where, for other reasons, it is not convenient to provide a voltage delay for the whole AGC system, there is much to be said for delaying the control voltage on the RF amplifier at least, so as to preserve the best possible signal-to-noise ratio for weak signals.

Delayed AGC in a TV set may be considered as directly equivalent to delayed AVC in an ordinary broadcast or short-wave receiver.

(6) Application of AGC bias to the controlled valves should have as little influence as possible on the overall shape of the receiver selectivity curve.

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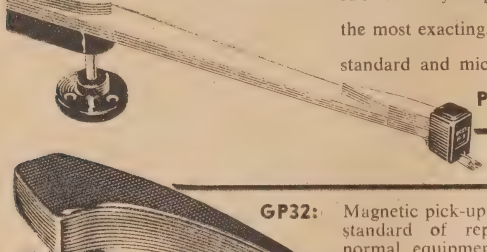

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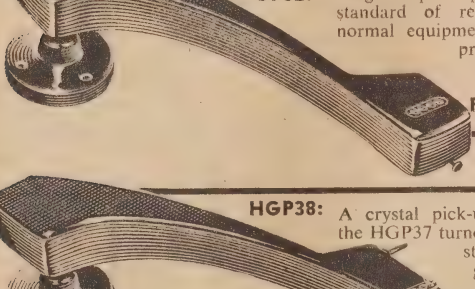

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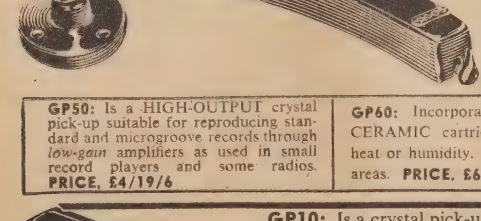

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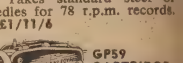

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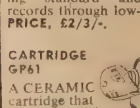

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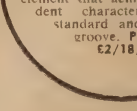

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lve varies with operating condi-
and therefore with the control
plied to its grid. This may affect
sonance and "Q" of the input
and vitally influence the ultimate
ity curve.
le the effect cannot be avoided
tely, it can at least be minimised
lying the AGC bias predominant-
tages whose input circuit is broad-
d or heavily damped. This may
not be compatible with the need
id overload of certain stages.
against this general background,
hat AGC systems have to be de-

surprisingly, they are generally
omplex in a television set than
AM broadcast receiver.

STANDARD" CIRCUIT

erusal of local and overseas de-
indicated a wide variety of ap-
es to the whole problem and very
n the way of a "standard" AGC
Servicemen must therefore be
ed to work from manufacturers'
nd to treat each design on its

e receivers use a very compre-
control system and are about
of against overload, fading, flutter
oise interference as the design
er can reasonably make them.
receivers can be relied upon to
to advantage in any situation.
er receivers use much simpler
ls, with correspondingly fewer
and parts. They would be satis-
in the majority of locations but
ow up poorly by comparison in
where any of the aforementioned
ties are prevalent.
tracing AGC systems through
commercial circuits, the reader
ell be intrigued by the circuitous
llowed by the wiring and by the
r of filter capacitors and resistors
– some of them apparently re-
lt. This naturally tends to make
em appear even more complex
really is.
explanation is not difficult to dis-
Originating, possibly, at the video
r, the AGC voltage has to pass
e IF strip and into the tuner.
te, it may need to pick up supple-
y voltages from a suitable HT
from the synch. separator stage,
keyed AGC amplifier or from the
flection circuits.

M COUPLING

essential that, in following such
se, the AGC wiring does not pro-
egenerative effects or stray coupl-
tween incompatible portions of
ccuitry.
n, because television receivers are
ly constructed in unit form, the
C wiring cannot always be run
oint to point by the most direct
e. It must conform to the basic wir-
ttern by which the various cir-
its are interconnected. (This is
cly true to receivers assembled
printed circuit boards.)
s result of these two basic factors,
AGC wiring is often found to fol-
rather circuitous route around the
ss and around the schematic cir-
. Bypass capacitors and resistors
pear at one end of a wiring run,
hough their function is apparently
li ted at the other end, where the
same wire enters another circuit group.

Figure 123 shows an AGC system extracted from an overseas portable TV set. It is a quite elementary arrangement, which is essentially no different from a simple AVC system in a broadcast receiver.

The control voltage is picked up from the video detector load, the detector being polarised to produce a negative rectified output voltage.

The voltage is filtered through a 0.82meg. resistor and 0.33mfd capacitor, then applied to the RF amplifier and second IF amplifier. The mixer and first IF amplifier valves are not controlled.

It is noteworthy that, as far as the circuit is concerned, the .001mfd feed-through capacitor is in parallel with the main 0.33mfd filter unit. In practice, the feed-through capacitor is desirable to ensure that signal energy does not enter or leave the tuner, to cause trouble of one kind or another

SIMPLE SYSTEM

Figure 123 is included mainly to illustrate what probably constitutes the ultimate in simplicity for a television AGC system. It does not conform to all the varied requirements listed earlier, but is apparently justified by the need in such a set to economise in space and weight.

In a portable receiver, the owner is probably prepared to accept some limitation in performance, added to which the set would not normally be saturated with signals from a large aerial system, operating close to the station site.

Figure 124 shows the essential details of yet another AGC system extracted, this time, from a popular overseas domestic receiver. Though more elaborate, at first glance, than figure 123, it is still quite elementary in concept.

The basic control voltage is derived, as before, from the video detector load. Through a network of resistors and capacitors, approximately two-thirds of the voltage is applied to the first IF grid, the remaining two IF stages operating with fixed bias.

At the same time, the full control voltage is applied, after filtering, to the grid of the RF amplifier, the mixer operating wtih fixed bias.

The intention of the system is presumably to effect as much gain reduction as possible on strong signals in the RF amplifier stage, where the signal amplitude is lowest.

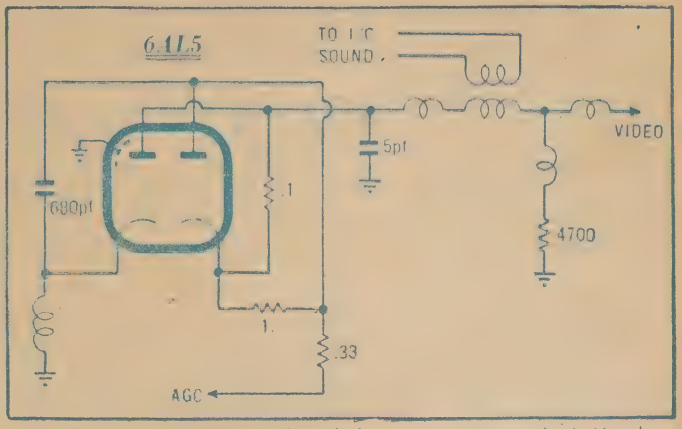

Figure 126: In this circuit, the left-hand diode operates as a conventional video detector. The right-hand diode is a voltage doubler, increasing the order of AGC voltage for a given input signal.

Further control is exercised in the first IF amplifier, but the order of control voltage is reduced, presumably to prevent this stage from being carried too close to cut-off on strong input signals.

Since the AGC system is fed directly from the detector load, even very weak signals will generate some initial bias and reduce, quite unnecessarily, the gain of the controlled stages.

This is offset, in figure 124, by the provision of a "Local-Distant" switch, which connects a high value resistor from a high tension point to the AGC line. The circuitry is such that a small positive bias is applied to the RF grid, sufficient to carry it towards the grid current region.

The need to manipulate such a switch would seemingly be a nuisance, but, in practice, it would probably never need to be shifted from one setting or the other in any given location.

OTHER IDEAS

Figure 125 contains two interesting additions to the ideas already discussed and represents a further step in the evolution of AGC circuits.

As in the previous examples, this circuit derives a control voltage from the video detector and applies it, after sundry filtering, to the RF tuner and first IF amplifier. A 10-meg. resistor from a HT point serves to cancel any residual bias on weak signals.

Instead of allowing the grids to drift substantially into the positive region, the design provides for a diode element wired between the junction point on the AGC line and earth. By normal conduction, the diode prevents any sub-

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positive voltage from appear- the line and ensures that the con- grids will operate from zero bias.

ng in this role, the diode is y referred to as an "AGC

gme 125 and, in fact, in most systems, a divider circuit can ed from the HT point through ious filter resistors to the detec- d resistor. This latter point s negative with input signal, so re is a potential gradient along C line, from negative to posi-

IUM LEVEL

suitably proportioning resistor n this network, it is quite pos- arrange for the positive poten- predominate at the clamp diode e signal strength at the detector a predetermined level. The ius continues to hold this clamp the line to earth potential and lays the application of AGC to ves fed from it.

oon as the signal level exceeds letermined figure, and the result- ative potential predominates at mp point, the diode ceases to and virtually disappears from cuit. The negative voltage is ssed on to the controlled grids, only by the dividing action of meg. or whatever other large is returned to HT.

p diodes are used very freely vision receivers to secure this AGC effect, particularly for the olifier stage. Since only a DC is involved, the clamp diode located anywhere in the chassis often found as the second diode L5 video detector or as a spare n an audio amplifier valve.

is a further interesting point igure 125 which has not thus en mentioned, namely the deriva- a supplementary control voltage e synch. clipper stage.

BIAS

e normal way, the synch. clipper n at fairly high level from the mplifier. It draws grid current herefore tends to develop a stand- ative bias proportional to the vel. This bias can be used, as e 125, to supplement that pro- y the video detector.

nother means of supplementing mal detector bias is illustrated e 126.

half of a 6AL5 twin diode is s a quite conventional video , with normal load, peaking coils rrier take-off transformer.

voltage developed across the load ied, through isolating resistors, plate and cathode of the second ection. This latter is fed with from the input transformer a 680 pf capacitor.

e presence of signal, the plate move negative and the cathode with respect to the externally voltage. However, the cathode fairly close to the video detec- potential by the 0.1 meg return whereas the plate return re- the same point is 1.0 meg.

in the presence of signal, the t developed at the plate of the diode is substantially added to

(Continued on page 111)

TROUBLE WITH KITCHEN SYNCH.

These pictures, snapped recently in our laboratory, indicate typical TV image troubles. Above, the line oscillator is losing synch. at the start of each frame causing the top of the picture to tear away.

Weak input signals are modulating the picture tube grid reasonably well but are failing to lock the horizontal oscillator reliably. The picture is just beginning to break up.

The input signal here is weak and barely able to lock the horizontal oscillator. In addition there is a leading ghost and another displaced to the right of the main image.

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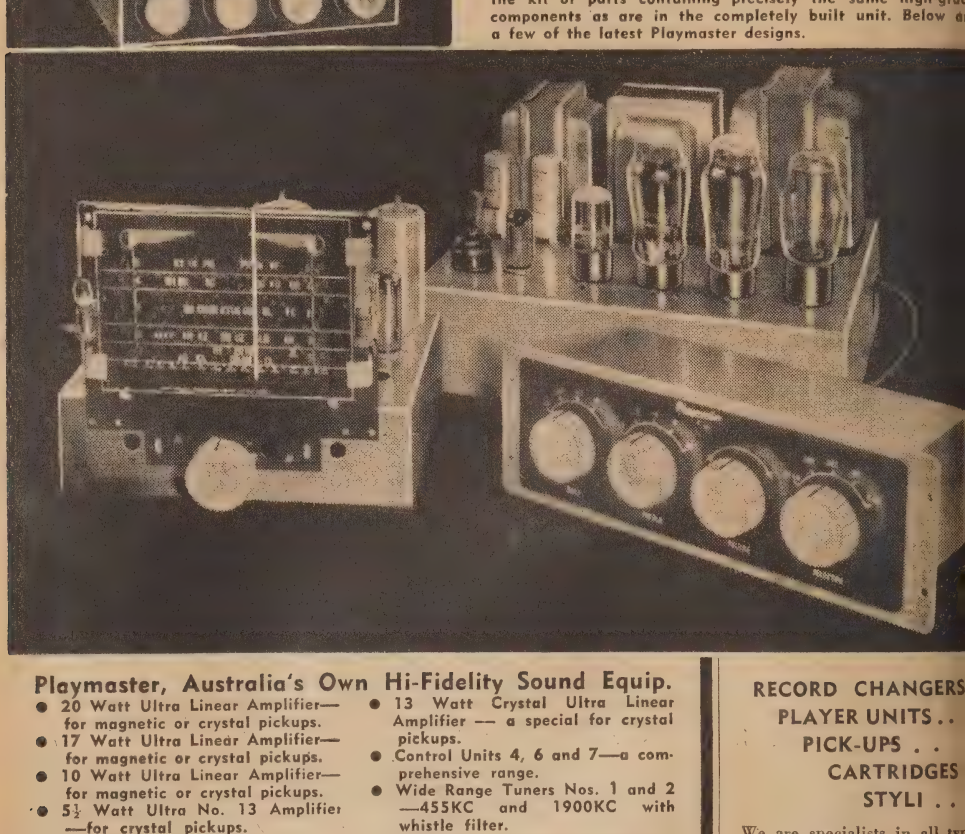

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ROM THE SERVICEMAN WHO TELLS

seems that some of the comments I have been making in recent articles have been more provocative than I imagined. During the month one reader has taken me severely to task my comments about false 3D claims, while another is not entirely convinced that valve companies always do the right thing by claims under guarantee.

walked into the R.T. and H. ice the other day, during one of dodical visits, staff member Phil bore down on me.

rikey," he exclaimed, "there was on the phone the other day to have a piece of you."

I inquired, "what have I done

it seems that you wrote some- the last October issue about a and similar motion picture and this chap was quite upset

He said to tell you that he n Cinerama recently in the US it's terrific—really terrific."

went on to explain that this I understand he is one of the profession—appeared to get orked up over Cinerama. In tones he described aeroplane hich had him clutching his seat ling airsick and other similar ces.

E TICKET

ay," he said, "You tell the ser- next time you see him that, Cinerama comes to Australia, should go and see it. If he consider it terrific, I'll gladly him the price of his ticket."

ing some time since I wrote le for the October issue, I began er just what it was I had said inerama which was so deroga- which so incensed the good . So I checked on just what I ten.

arely enough, the only reference find to Cinerama (etc.) was that stems were ". . . about as three- nal as a pancake which had der a steam-roller".

'll stick by that statement.

t find any reference to Cinerama good. In fact, from all the s have heard, I am quite ready ie that it is, as the doctor says, rrific. I simply said it was not stem. Again, I'll stick by my ct.

OT 3D

t things into their true perspec- me point out that my real that occasion was the reference ews par) to a TV 3D system ad been ". . . developed from le principle as VistaVision and a, etc.", thus implying that these were 3D systems. Since they the statement is incorrect.

ay, I would like to thank the or his kind offer to "shout" if I le Cinerama. Frankly, I think oy is pretty safe. For one thing, whether we will ever see a in Australia (more's the pity), nother I am quite sure I would enjoy it. In fact, I might even consider it "terrific".

But it still isn't a 3D system!

The next reader-comment is on an entirely different—and somewhat more serious—theme.

Following my article in the January issue concerning the replacement guarantees on picture tubes, I have received a letter from a reader, W.W., of Roseville, Sydney who is worried by a valve replacement problem. The relevant portion of his letter is reprinted in the adjacent panel.

In some respects I feel that it may be difficult for me to comment fairly on this situation. While I have no doubt that W.W. has given me what he honestly believes to be a fair and unbiased account, the fact remains that I have still only heard one side of the story. Hearing the other side might not throw any more light on the problem, but, then again, it might.

However, I do feel I can make some comment which might help to clarify a few of the points raised. The first concerns the possible effect of overload on valve life — this being prompted by the statement that a 20 pc overload (in screen voltage in this case) should not cause a reduction of valve life to 1 pc.

CLOSE TO MAXIMUM

This suggests that the order of life expectancy would be reduced by roughly the same order as the overload. While this might be true in some cases, it is definitely not an infallible assumption.

In this set of operating conditions, for example, the screen is running very close to its maximum ratings and beyond this point there is a very real danger of overheating and the release of occluded gas. Once this happens the stage is all set for the flow of control grid current, overheating of the control grid, the release of more gas, heavier grid current, and

OUTPUT VALVE OPERATING CONDITIONS

Being a summarised version of the letter referred to in this article

"I read your article in the January issue on the subject of valve and picture tube guarantees and I would like to share one or two of my experiences with you.

The case in practice was a P.A. amplifier of my own design using push-pull and giving 40 watts output. The ratings used were similar to the ratings used for the Ultra Linear Amplifier-440 plate volts, common cathode resistor of 250 ohms. In practice the cathode resistor was adjustable and was set to give a plate current of 62.5 mA per tube. HT was 410V and screen current 7.5 mA per tube.

The amplifier performed according to expectations on the bench and it was sent out to a job. I was told that the performance of the gear was not good—the equipment having been in operation for four hours. I did not have time to look at it immediately, so I put it aside for a couple of months, when I required it for another job.

On switching on I noticed that one of the output plates was glowing red On checking with the meter I found that the plate current of one tube was 80 mA and the other was 20. I then replaced the 250 ohm common cathode resistor with a 500 ohm in each cathode. The plate current of one tube was now 45 mA while the other was 15 mA. HT was 420 volts.

The tubes, by the way, had been used at U/L ratings but the screen of each valve was returned to HT through a 1000 ohm resistor. I sent the valves back for replacement.

When I came to enquire about the tubes I was told that the valves had been subject to overload and that they could not be expected to operate under these conditions.

I referred to the literature on the subject and was told that in U/L operation as per these conditions the screen and plate were at the same potential. By returning the screens to HT the relative potential of the screens was increased (I estimate some 10 volts) thus causing the detrimental effects mentioned.

This theory did not cut much ice with me. In any case I could not see how a 20 pc voltage overload could cut down valve life to 1 pc of the expected figure, especially as I had overbiased the valve to keep it within its limit.

However, that was not all. In the next breath I was told the valves suffered from cathode poisoning. To me, cathode poisoning suggests undervoltage of the filaments, while the overload theory suggests excessive voltage on the plates.

As I was in a hurry I did not press the matter there and then. However I took the first opportunity to discuss it with another valve engineer. His comment was that the design circuit was unusual but that the valves should operate quite satisfactorily under these conditions.

Your Faithfully,

W.W. (Roseville, NSW).

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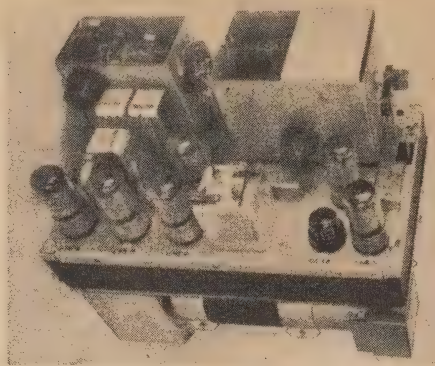

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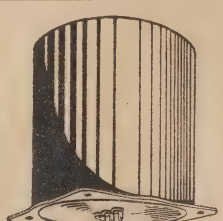

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430		200
500		27
500		100
700		20
850		20
1000	C.T.	150
2000		150
2500		85
3750		30
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5000		20
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, until the valve ultimately destroys

point to appreciate here is that ave created a highly destructive away" condition which bears little nship to the comparatively minor bad which triggered it off. Such a ion could have been the cause of particular failure, though I think there are other more probable

other point concerns cathode ning. In general, there are two which this might take — one due under-running of the cathode rela- the plate and screen voltages, and ther due to the release of gas, as ly described. In the latter case the combines chemically with the de material effectively to poison it.

first effect, generally termed sion starvation", could be caused use of a power transformer which little on the lean side, and which delivered reduced voltage to the s. This condition would be aggra- by over-long heater wiring or by creen and/or plate voltage being r than they should be.

hink it more probable, however he effect was due to gas released result of some form of accidental ad.

SIBLE PARASITICS

ile this overload could have been ic one in the manner I have already sted, I think it more likely to be to parasitic oscillation. This is s a possibility where high Gm s are involved.

rthermore, such a parasitic condi- need not be immediately apparent. i often an amplifier might appear tly docile until driven to some like its maximum power output it will "spill over" and remain in ition indefinitely — or until some- blows up.

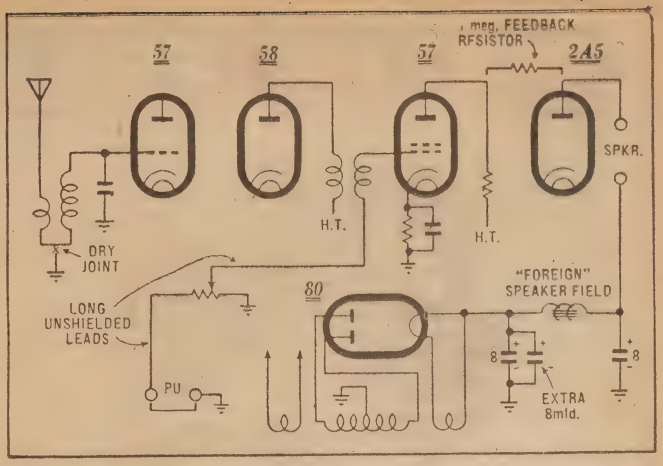
pure speculation, of course, but I st that something like this might happened to W.W.'s amplifier ose, for example, that the bench test failed to drive it to its full output, herefore failed to show a tendency rasitic oscillation. In these circum- es the amplifier would have ap- d to be functioning quite normally be sent out into the field.

'E HARD

is is where it would be most likely driven to full output — or even d — and any tendency to parasitic iation would certainly show up. ally, under such conditions of tion, this situation would not neces- be noticed immediately. By the cit was, the valves could have suf- a severe and prolonged overload. is, in turn, could have released which not only ruined the perform- of the valves when next they were but also poisoned the cathodes. it would have been perfectly feas- or the valve company to find evi- of both these conditions.

case this explanation appears to the valve company unduly, let me n to assure my correspondent that e tried to view the problem as ob- tely as possible and, at the same find an explanation which would to fit in with the observations of parties.

t, even assuming that the explana- is a reasonable one, I feel that the



Here is the old time autodyne circuit which gave the Serviceman trouble this month.

radio dealer was probably not as helpful as he might have been in not suggesting the possibility of parasitic oscillation.

Of course, it is possible that the valves were, in fact, faulty, and that both the radio dealer and myself are on the wrong track. Since my own explanation is pure theory, I won't flog it any further.

And that, I feel, is about as far as I can go toward solving the mystery.

TWICE TRICKED

Coming back to the more mundane matters of everyday service work, I must confess, somewhat shamefacedly, that I have been tricked twice this month into jumping to a false conclusion.

The first set was a home-made job, a five-valve mantel set, made to one of the R.T. and H. designs. The present owner was not the builder, so he was forced to seek outside help when something went wrong. I was given to understand that the set had performed perfectly for several years but had now stopped completely.

This particular trouble was not hard to find, though it was a little unusual. Apparently the volume control had worked slightly loose over the years and some heavy-handed member of the family had given it a severe twist.

BROKEN LEAD

The result was a broken lead from the centre contact, with the outer contact shorted to the shield braid, just for good measure. A few minutes' work with pliers, spanner, and soldering iron was sufficient to repair the damage and to ensure that it would not happen again.

Then I switched the set on, waited for it to warm up, and tuned in a station. At that precise moment I was called to the telephone and left the set playing softly on the bench. When I returned a few minutes later I was surprised to observe that it was completely silent. I turned the volume full on and observed some faint and badly distorted signals, while tuning in a stronger station produced a similar effect on an even larger scale.

The nature of the distortion was particularly interesting and is easily recognised with a little experience. It was a choking kind of sound with the very weak portions almost completely suppressed, most of the remainder badly distorted, and very loud portions almost normal.

IN THE GRID CIRCUIT

This was demonstrated quite forcibly while I listened. The announcer was trying to say, "This is station 2UW Sydney. The time is exactly 10 o'clock", but all I heard was a choking gurgle, which was barely intelligible. However, riding over the voice came the pips of the 10 o'clock time signal, surprisingly loud and clear.

By this time I had mentally diagnosed the trouble as an open grid circuit in either of the audio valves, and I picked the output valve for first try because it appeared to be easier of the two. Picking up a screwdriver, I momentarily shorted the grid to chassis, a procedure which restored the set's performance like magic. Then I waited.

Sure enough, after a few seconds, the signal became noticeably weaker and continued to deteriorate for the next half minute or so. Then, as if making a last dying effort, it suddenly regained some of its strength for a few seconds, finally giving up the ghost as it slid rapidly into the choking distortion I have already described.

Next, I reached for the ohmmeter with the idea of confirming that the grid resistor was open circuit. The resistor itself was almost hidden beneath the coupling capacitor, but the two terminals between which it was mounted were readily accessible. As I suspected, I could observe no sign of continuity between them.

I fished a new resistor out of the bin trimmed the leads to size, tinned the ends, and then set about removing the faulty one. However, as soon as I lifted the coupling capacitor out of the way I realised I would probably not need a new resistor after all. A more likely cause

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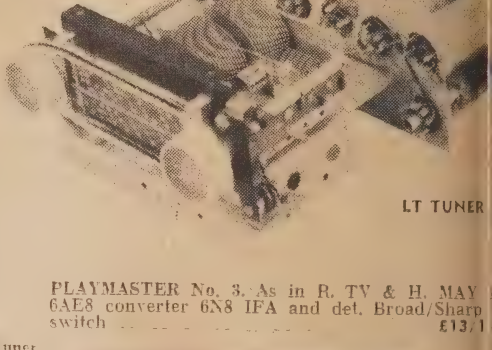
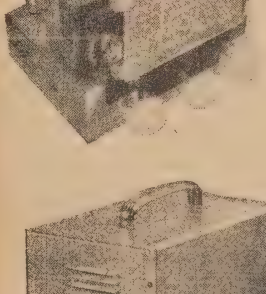


LT TUNER



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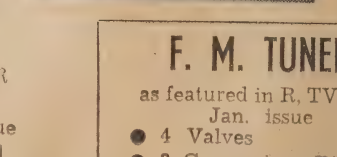

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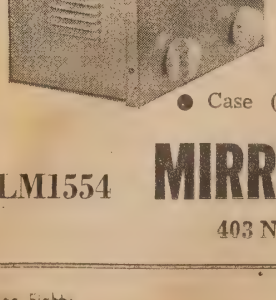

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trouble was the fact that one end resistor had never been soldered, d being merely pushed through the the solder lug.

as only a small point, of course, does show how easy it is to be. In this case, it didn't matter darly, but I can think of plenty of where a similar erroneous assump- uld lead one a merry dance.

pical example is the valve socket lug broken internally. A measure- at the socket will indicate voltage applied to all pins, and one natur- ssumes that these voltages are g the valve elements. The only that the set won't work.

LD TIMER

in spite of this jolt to my con- ey, I must confess that I fell for a trap only a few days later. In se, the set was a real old-timer; one the normal way I would have re- nded for the scrap-heap. But the had a certain fondness for it, plus that he didn't feel in a position st in a new set right away. So I would see what I could do with it.

as an old autodyne model, using me-time popular 57-58-57-59-80 nation. The owner confessed quite that he had been fiddling with justments and, in fact, considered ll that was required was correct ent to clean up the mess he had of things.

set it up on the bench, fed the or into it, and commenced to dle" it. Strangely enough, the IF l seemed to be fairly close to op- gain was reasonable and only one er was more than a fraction of a rom a true peak. The only point ied was a tendency to instability touched the alignment tool on f the trimmers, even though it con- a minimum of metal.

dn't pay a great deal of attention , remembering how touchy some se sets were in the old days. At me time I made a mental note could have some significance.

t I tried the aerial and oscillator s. Here I did find evidence of ning wrong. The gain was poor e aerial trimmer refused to peak. spicion that the aerial coil was was strengthened when I tried to the padder. Shifting the padder the dial setting all right, but each had exactly the same order of suggesting that the aerial tuned was contributing nothing to either in or selectivity.

CIRCUIT

ied a continuity check from the grid to chassis. Since there was C circuit this should have shown v resistance of the aerial secondary g. Instead it was a complete open

fident that I was on the track, I the chassis over and checked y that the lower end of the second- d in fact connect to chassis. It ed that it did, along with the end of the primary winding, which mpered to it.

dn't fancy re-hashing the chassis a new aerial coil if it could be d, reasoning that it might be easier air the old one if the break was s. Accordingly I unscrewed and ered the coil, slipped it out of the d began a careful examination of nding.

I had expected to find a spot of verdigris somewhere on it; a not uncommon fate of some of the earlier, not-so-well impregnated, coils. But the coil was perfectly clean and I could find no sign of a break. But what really rocked me was when I tried the ohm meter across it and found everything intact.

Thinking in terms of intermittents, I went over the coil most carefully, wriggled the terminals, checked for dry joints and finally convinced myself that there was nothing wrong with it. What, then, was the explanation?

The only clue I had was a suspicion—now that I came to think about it—that the lead from the coil terminal to the chassis had come unstuck rather more easily than it should have. Unfortunately the coil was still rather firmly supported by other leads at this stage and there was no positive evidence that the joint was faulty.

At the same time I felt that this was probably what had happened. I realised that I had not made my continuity check to the coil pins, only to the chassis, falsely assuming that this portion of the circuit was intact.

A FALSE TRAIL

So, once again, I had allowed myself to be led along a false trail, this time to the extent that I had wasted considerable time removing, checking and replacing a coil quite unnecessarily.

When I did replace the coil, making sure that all joints were really intact this time, the set came good immediately. The trimmer peaked, the padding adjustment revealed the spot where the aerial circuit was resonating, and the gain rose to a more normal figure. For the moment, at any rate, performance seemed normal.

But after listening to it for a few minutes I realised there was still work to be done. There was quite a merry little hum in the speaker, still some evidence of instability, plus a level of distortion which, if it wasn't due to a faulty component, was still higher than one is accustomed to in this day and age.

I tackled the hum first. The original wet electros had long since vanished and been replaced by a pair of dry 8 mfds. I assumed that at least one of these had probably also failed. Bridging each in turn with a new one seemed to indicate that the first one was at fault, the hum dropping appreciably when it was bridged.

However, when I replaced the one with the other the hum was just as bad, and further checks indicated that it was simply more capacitance that was wanted. This seemed to be the easiest way out of the problem, but I couldn't help wondering why this was necessary, since the set still had the original amount of capacitance in circuit.

DIFFERENT SPEAKER

Thinking the matter over later I remembered a point which the owner had mentioned and which might have some bearing on the matter. This was the fact that the original speaker had developed a nasty rattle several years ago and had been replaced by one salvaged from another set.

It occurred to me that the replacement speaker could differ from the original in several ways, which could affect the hum level. (1) It could have a field with a lower value of inductance; (2) it could have a poor hum-bucking coil, or none at all; (3) it could have a higher overall sensitivity.

The possible effect of the first two changes is fairly obvious, but it is not always fully appreciated that improved speaker sensitivity can also complicate the hum problem.

Yet it is fairly obvious that a given amount of hum in any piece of equipment will produce a greater level on a sensitive speaker than an insensitive one. Further, whatever proportion of hum is generated after the volume control will remain constant regardless of the setting of the volume control.

TRACING THE HUM

Thus, when using an insensitive speaker, the hum is automatically reduced, while the gain is simply moved to a higher setting to produce the required volume. If a more sensitive speaker is substituted the gain will have to be reduced, but the hum level will be increased.

This could be a major reason why the gradual increase of speaker sensitivities over the years has resulted in a simultaneous increase in filter capacitor values. Whereas we were once content

(Continued on Page 83)

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RADIOTRON

TELEVISION VALVE SERI

The Radiotron 6BQ6GTB/6CU6 is a high perveance beam power valve designed especially for use in horizontal deflection amplifier service of television receivers. Design features include a mount structure which permits cool operation of both grids to guard against grid emission. The plate structure is such that heat is distributed evenly and not localised to form hot spots.

These factors, in conjunction with high design ratings enable this valve to deflect picture tubes having deflection angles up to 90 degrees.

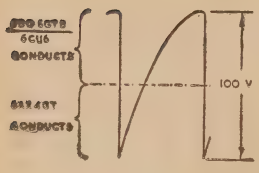


Figure 1

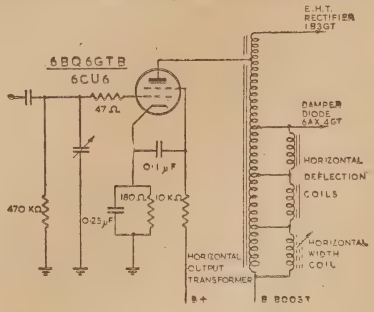


Figure 2

The horizontal sweep oscillator (Radiotron 6SN7GTA) provides a signal of roughly sawtooth-form to the grid of the 6BQ6GTB/6CU6 (see Fig. 1). (Figure 2 is a typical circuit of a horizontal deflection amplifier.)

During the first half of the negative but positive going sawtooth, the valve is biased beyond cut-off (for this period, the 6AX4GT damper diode provides current to the deflection coils — see earlier article). As the input signal becomes less negative, the 6BQ6GTB/6CU6 commences to conduct. The output current is transformed through the horizontal output transformer into the deflection coils of the yoke to provide the second half of the sweep.

Due to the sawtooth form of the input signal, the peak current that is drawn by the plate may be 3.5 times the average current.

At the peak of the signal, which corresponds to the end of the horizontal sweep, the sudden negative pulse cuts the output valve off. This change in current through the output transformer, taking place during a few microseconds, results in a high peak voltage on the plate of the 6BQ6GTB/6CU6. This valve is designed to withstand a peak positive pulse plate voltage of 6000 volts.

CHARACTERISTICS:

Heater Voltage	6.3 volts
Heater Current	1.2 amps.

MAXIMUM RATINGS (Horizontal Deflection Amplifier):

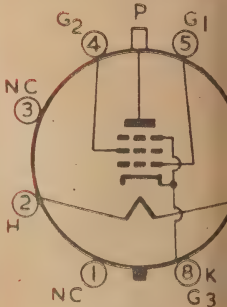
Direct Plate Voltage	600 volts
Peak Positive-Pulse Plate Voltage *(abs. max)	6000 volts
Peak Negative-Pulse Plate Voltage	1250 volts
Direct Grid No. 2 Voltage	200 volts
Peak Negative-Pulse Grid No. 1 Voltage	300 volts
Peak Cathode Current	400 mA
Average Cathode Current	112.5 mA
Plate Dissipation	11 watts
Grid No. 2 Input	2.5 watts

* **The duration of the voltage must not exceed 15 per cent. of one horizontal scanning cycle. In a 625 line, 25 frame system, 15 per cent. of one horizontal scanning cycle is 10μ sec.**

† **For further information on the 63Q6GTB/6CU6 and other Radiotron Television Valves consult the Radiotron TV1 Booklet. Additional copies of this advertisement are available free and post free on request.**

6BQ6GTB/6CU

SOCKET CONNECTIONS



(bottom view)

Pin 1 — No Connection
Pin 2 — Heater
Pin 3 — No Connection
Pin 4 — Grid No. 2
Pin 5 — Grid No. 1
Pin 7 — Heater
Pin 8 — Cathode, Grid No
Cap — Plate

AMALGAMATED WIRELESS VALVE CO. PTY. L

47 YORK ST., SYDNEY

HIW TO BUILD YOUR LITTLE GENERAL CABINET

With a little care, you can make a cabinet with almost a professional ...uch to house your Little General, complete with a calibrated dial ...ate to match. This short article gives you some hints about how to do it.

MMENCE by cutting out the vari-...ous pieces required in the assembly ...e cabinet. The two sides are of 3-8 ...and when cutting add about 1-8in ...e dimensions given, for planing. ...h two pieces may be placed in the ...e and planed simultaneously. The ...piece has a suitable fret cut out, ...the right has a ¼in hole for the ...tiometer.

...e top and bottom pieces may be ...out next, allowing for the curva-...re in the length of the top piece. ...-sixteenth ply should be ade-...te. The grain in the bottom piece ...uld run from side to side for ...d rigidity.

...e front panel of the cabinet is ...up of two thicknesses of three-...enth ply, which are cut about ¼ inch ...cess of the dimensions given to ...easy assembly.

...CULAR CUT-OUT

...xt, a circle to the dimensions ...is marked on one of the pieces ...cut out with a circular cutter or ...saw. The edges of the cut-out ...sanded, and the piece with the ...ut is coated with glue. A ¼ inch ...for the spindle is drilled through ...ncut piece of ply.

...e two pieces are now sandwiched ...ner, making sure this spindle hole ...curately centred in the circular ...ut. Place a weight over the sand-...ed pieces and leave to set.

...obtain the required curve in the ...piece, make up a simple jig. This ...sts of a length of timber with two ...ch high blocks nailed 7 inches apart, a strip of metal bent to the right curvature, and a G-clamp.

The method is just to soak the piece of ply thoroughly in water. Lay it on the jig with the two ends just overlapping the blocks so that the ply is forced into a rough curve. The curved metal strip and G-clamp will hold it in this position. The whole assembly is held in front of a radiator or a similar source of heat. In the process of drying steam will be generated to fix the curve. When the ply is thoroughly dry allow the complete assembly to cool.

The top outside edges of the side pieces may now be bevelled to the correct angle to take the curved top. The sides are fixed to the bottom piece by means of glue and panel pins and the top likewise, taking care to ensure that the whole assembly is square.

When the work completed so far is dry, the set may be installed and the front panel aligned in place with regards to the spindle. A rough outline of the cabinet shape is then marked and cut out, and the piece is attached to the remainder of the cabinet by means of glue and panel pins. The set should remain in the cabinet during this operation to ensure correct alignment of the spindle hole and spindle.

...OM THE SERVICEMAN WHO TELLS

(Continued from page 81)

...4 mfd paper types, then 8 mfd ...olytics, we now think in terms of ...4 and 32 mfd units.

...em to have digressed a little from ...ory of the old set, but I felt that ...bove point could well stand some ...ication. Now, back to the set.

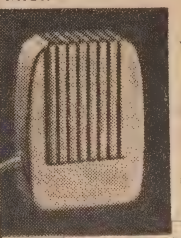
...ving cured the hum, I next won-...re about the general "soupiness". ...ii there were a good many things ...ii could cause oscillation, I was in-...to discount most of them, mainly ...ase the condition wasn't bad enough. ...set wasn't actually unstable, only ...ely touchy.

...n I noticed a couple of leads run-...g from the pickup terminals at the ...of the chassis to what appeared to ...second volume control at the front. ...y because the wires were plastic-...ed, I felt sure that they were not ...f the original design.

...t was a rather weird and wonderful ...angement, but to appreciate it fully ...s necessary to recall just how these ...ckup terminals were fitted. The ...tionary position was between the ...ve end of the second IF secondary ...f chassis, a link between these two ...nals completing the IF circuit when ...ckup was not required.

AWA RONETTE

MICROPHONES & ACCESSORIES



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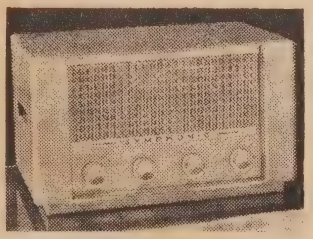

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To match all
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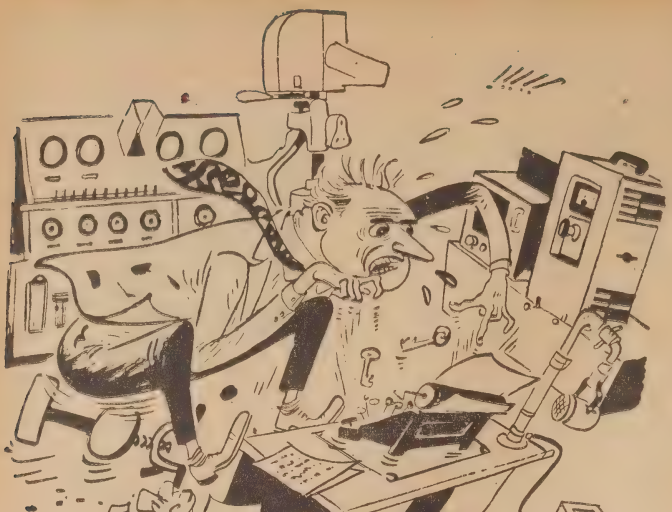


Let's Buy An Argumen

As one sits facing the typewriter, this month, it is most difficult to know just where to sta Should it be television screen size, vintage motor cars, crystal sets or technical mysterie Perhaps the logical thing is simply to comment on these unrelated subjects in the order j mentioned and forget continuity for once.

by Neville Williams

THE dilemna is really the result of a habit I've developed of dropping all "Argument" matters in the front of the middle right-hand drawer . . . letters, magazine clippings and cript little notes.

Someone may be unkind enough to suggest they should stay there but that's not the point.

When the Editor thumps the table (impatient people always thump tables) there is nothing for it but to rake out the little notes and jottings to collate them into something that can reasonably fill the space under the allotted heading.

JUST THREE WORDS

The first of the notes to hand would not have meant much to anyone else, because it was caught between the leaves of a small book recently reviewed. It carried just three words "Phooey to Phil."

Actually, it referred to an argument with our confrere Phil Watson, as outlined in the February issue.

You may recall my suggestion that it was not sufficient to base ideas of television picture size on purely optical laws—how much detail the eye could or could not see, etc. No less important was the tendency of a picture to gain "impact" as its size grew in relation to surrounding familiar objects.

This being so, viewers would always tend to favor pictures larger than strictly necessary to see all available detail. The limit was met only when the line structure became so obvious that it actively disturbed them.

Phil wouldn't agree with this and still doesn't, to judge by his performance last week over morning tea.

As far as I was concerned at the time, the argument was original, though I don't doubt that other people had pro-

pounded it on other occasion other cups of morning tea.

It was with great interest.. the that I came across a brief discus the subject in a "Wireless World ication "Improve Your TV Rec (Cura and Stanley.)

The authors pointed out there "size comparison" is a very im matter in modern TV viewing.

In the bad old days, when te images were so dull and small th were viewed in darkness, the view conscious only of the picture and ally lost his sense of size.

EYESTRAIN

However, he stood a good cha gaining a headache due to ey brought on by staring fixedly at a object in a dark room.

Nowadays most people have t dom—and the wherewithal—to television under fairly high ambie conditions. Eyestrain is relieved size factor is introduced.

To quote from the book men

"The cabinet of the receiver b visible and the eyes subconscious in familiar objects in the room surround the receiver.

"As the size of the cabinet is the size of the screen which is abo foot across, immediately becom

parent, due to the fact that com can be made.

"Also, as the picture is o through an opening in the box once assumes a mechanical aspe whole proceedings appear unreal smallness of the screen is empha

ROOM DISTRACTIONS

"Add to this the normal dist made visible by room lighting mediately one loses that sense ticipating in the actual event, fo television is noted."

So say Cura and Stanley. At l not on my own.

What's next? Ah yes . . . cars!

This all began because I was a parallel case to people who get so much fun in wheedling ounce of performance from a sm by doing things the hard way!

The parallel I used was this:

"What possible explanation cou be, otherwise, for the practice o ing a fortune in time and mon an old bomb so it can qualif vintage car?"

soon found out that to say such a
g was to commit the unpardonable
in many eyes.
riticise a man's home if you must,
wife, his family, his work, even his
s about television picture size . . .
ut never, never, never say rude things
t his ancient jalopy!
o show just how deeply it goes, I
oduce a letter herewith from a
eler at Fairy Meadow, NSW. Though
ing as an individual, I strongly
pect that he represents a club or
ething — if there is such a body.
n fact his letter is endorsed with the
bols 26 FE B 57, which might be a
nbership number or merely the date
ngly typed.

T POSSIBLE

lis sentiments about vintage cars are
r enough, but, as regards vintage
io sets, he must surely be joking.
re couldn't possibly be old sets in
tence which anticipate the virtues and
tures of modern design!

musing fellow, what!

More to the point was the phone call
received on the same subject from
neone I had come to regard as a
nd.

His inquiry about my health and
ily was sufficiently formal to indicate
t it was merely the prologue to more
ent and unpleasant matters. I didn't
e long to wait.

discovered that this erstwhile friend
t long eschewed the products of Hol-
n, Ford, BMH, etc., for the pleasure
driving a 1920-something Sunbeam.

Nor did I help matters by exclaiming,
hat, that old thing with a steel and
body? That needs about a mile to
nd up a decent speed? That whines
e a . . .

That's as far as I got, because my
ler launched into an oration that
uld have made Cicero and his pals
ok like a schoolboy debating team.

With eloquence, firmness and convic-
n, he faced me with the following
ering facts:

(1) Not all old cars were vintage cars.
enty of models, particularly American,
re indeed "bombs".

(2) There was a difference between
ntage cars and "veteran" cars, but
th were subject to clear definition.

(3) the age group of such cars was not
vanced a year at a time in step with
e calendar.

RUDE SHOCK

All this came to me as a rude shock.
The old cars I had driven for years—
t being able to afford anything better
had been excused by me as "vintage"
odels. Now they were shown to be
d bombs — Yankee bombs!

And when my present car is old (and
id for) I still won't be able to pass it
as a vintage model. It'll be just
other ancient jalopy, another outdated
mb, made-in-Australia.

A man can't win!

Crystal sets?

Our remarks about the possibility of
aring shortwave stations on them has
voked a good deal of comment one
ay and another, but nothing to indicate
at shortwave signals are being heard
a widespread scale.

Various readers have mentioned hear-
g odd broadcasts from time to time from Australian, American, New Zealand and Chinese stations. A few amateurs are also heard, mainly on the 3.5 and 7Mc bands.

It seems that one has to chance upon the right time and the right frequency when the field strength of a particular station is high. Otherwise, the level of signal in the phones is too low to be heard.

TRANSISTOR SET

The most lengthy report of crystal short-wave reception comes from a reader in northern NSW, who reports excellent and even loudspeaker reception of various short-wave stations. But this reader isn't using a simple crystal set. He has strung three or four transistor amplifiers after his crystal detector and rendered audible signals which would not otherwise be heard.

I wonder whether he drives a vintage car in his spare time?

Last but not least, this month, comes the business of technical mysteries. The particular one which has worried us, of course, is the reason for the post-equalising pulses in a television signal.

There are others, however, which cause one furiously to think. Here are some specimens, arising from some recent work with FM tuners and sweep-and-marker generators.

Is it logical to expect a marker pip to appear on the "S" curve of a ratio detector?

Why does the presence of such a marker pip, though apparently so small, often cause gross distortion of the said "S" curve?

Is it right or wrong to evaluate an "S" curve on anything but a DC coupled display circuit

Perhaps it's wrong to refer to such things as mysteries, because somebody, somewhere, knows the answer. Or it may be set out fully in some article or textbook.

The problem is to find the said person, article or textbook, when you want further information in a hurry.

I've tried out these questions recently on various acquaintances, without receiving much immediate help. They've either forgotten the problem or never given it much thought.

But that doesn't brand such folk automatically as technically inept. Radio, television — in fact all branches of electronics — are expanding so rapidly that it is near to impossible to keep up with any one of them, let alone the whole lot.

Of necessity, engineers are becoming more and more absorbed with their own immediate interests, having to be satisfied with a general idea of other things going on around them.

They're not likely, for example, to think twice about the post-equalising pulses, unless they come up against some problem which focuses attention on them. Nor are they likely to have considered the finer points of testing ratio detectors unless obliged to do so.

The point is, however, that until you find someone who knows the answer, many such problems remain as "mysteries". Take, for example, this busines of post-synch. pulses.

It all started—for us anyway—when a correspondent, G.T., wrote in the January issue and challenged our failure to explain the purpose of the post equalising pulses which follow the frame synch. block in a television signal.

He pointed out that we followed the lead of many supposedly learned authors in ignoring them. Further that vague references made by others to discharge of the integrating circuit were "right off the beam".

Since G.T. offered to provide the necessary explanation, we invited him to do so.

FIRST "EXPLANATION"

This was duly published in the February issue but without satisfying yours truly. After analysing the letter and pointing out certain apparent aberrations, we opined that the mystery of the post synch. pulses yet remained to be solved.

Who would do so?

Our original correspondent has written again to say that he is sticking by his explanation, which apparently

VINTAGE WIRELESS — WHAT NEXT?

Dear Mr. Williams.

Now you've done it. Done it at last, after reading with calm detachment every copy of your paper since the first W.W., you have actually made MY blood boil.

Sir. You ask, in an otherwise excellent article, "What possible explanation could there be for the practice of spending a fortune in time and money over an old bomb so that it can qualify as a 'vintage' car?"

If this were a motoring paper, Sir, I would borrow a page or two to explain the difference between an old car and a "Vintage" car, the contribution to motoring achievement made by a reappraisal of early ideas, (e.g. the de Dion axle) the invaluable service to the development of transport which the preservation of earlier types provides, the utter joy of motoring high wide and handsome with 7½ litres firing every other telegraph pole.

But have a care Sir, History is beginning to catch up with you. Only yesterday, I was speaking to one of your readers who is busily engaged in re-building a nine valve Neutrodyne and anxiously trying to swap an Amplion Q type, swan neck speaker for a four gang condenser. And who has not heard of the Illawarra Armstrong Super-Regenerative Club?

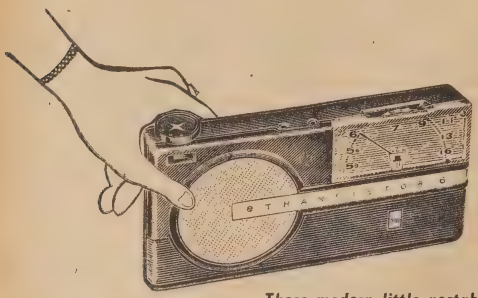
Already, I can see the true Vintage Televist carefully nursing the last of his cathode ray tubes and loftily writing off the current all transistor, self powered, full colour, four dimensional televisor as "so much modern tin-ware." You have been warned.

Regards, R.B.

TRANSISTOR RADIOS

Give hundreds of hours from torch batteries

Now you can own a truly portable radio incorporating transistors, the tiny electronic marvels which obviate valves and cumbersome B batteries. These smartly styled receivers from Pyrox give excellent reception with high sensitivity using only standard torch batteries costing approximately four shillings.



Above is the all-purpose Model TR 72 for home and outside use—equal in tonal quality to the best electric mantel models. Size 3¾" x x 9⅜". Weight, 4¾lb. Left is the slim, versatile model TR6.

These modern little portable receivers are available from:

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- ★ Facilities for providing alternative playback characteristics for different makes of record.
- ★ A minimum of controls yet providing independent balance of bass and treble, quite apart from the comprehensive filter arrangements so well proved in the past.
- ★ Alternative output impedances from the Main Amplifier.
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hat looks very much like an im-
se.

Apparently I am not alone in failing follow the explanation, however. A der from Queensland (G.C.F.) says t G.T.'s explanation "leaves him pletely at sea". However, he says t he cannot see any particular mys- about the post equalising pulses. uote:

HER IDEAS

The post equalising pulses are merely erted to return the circuits to the e residual level as prior to the field se in a somewhat symmetrical way. y also ensure the horizontal synch. ng in step at the end of a field nge."

The first part of the paragraph might right. The second part is so de-itfully general that it might be hard prove wrong.

But precisely why do the post equalis- pulses "ensure the horizontal synch. ng in step at the end of a field nge?" That's the hard part.

R.K.M., of North Sydney, also dis-sses the problem rather lightly. He ws a couple of theoretically integrated veforms and says:

'As you can see, if the oscillator ggers at the peak of the integrated out-, pairing of the interlace results due the varying effect of the horizontal ch. pulse following the vertical synch. lse."

Unfortunately R.K.M.'s argument os over his little word "if".

The frame oscillator should not gger at the peak of the integrated veform. It should trigger consist-ly at some point along the upward pe, the point being dependent on cuit details and operating conditions. Once the frame oscillator has trig-red on this upward slope, the re-ainder of the integrated waveform ases to matter. Just how the peak ls or how the circuits discharge is mingly of no importance thereafter the frame circuitry.

The most involved explanation I ve heard carries a hint of all the planations listed to date.

It suggests that the post synch. lses are significant only to certain ceivers using an assymetric multi-brator for the line oscillator, directly ggered by the synch. pulse and there-re not protected by any form of fly-heel circuit.

WRONG TRIGGERING

The story is that some such multi-brators have a short recovery time and e prone to triggering on the odd field the rear slope of the half-line pulse hich follows immediately on the frame nch. pulse interval. (Terminology is used in the Australian Standards).

The interval represented between these to points is about 65 pc of a full line.

In some rather mysterious way, the lf-line pulses which follow bring the ultivibrator back into step and ensure hat the proper grid triggers thereafter the appropriate line pulses.

This I can't accept, at least in the rm suggested. If a multivibrator is so predictable that it can trigger on a downward stroke at 65 pc of a full line, why doesn't it tend to trigger on the downward stroke of the pre-equalising pulses which themselves occur beyond 50 pc of a line?

In other words, why don't the pre-equalising pulses cause the very trouble that the post-equalising pulses are supposed to correct?

And, for good measure, here's an entirely different explanation, which has been put up to me:

Synch. separation circuits tend to establish their own operating level such that they suppress the video information and pass only the spikes corresponding to the line synch. pulses.

When the vertical synch. pulses arrive, their greater energy disturbs the operating levels of the separation circuits and possibly reduces the height of the effective spikes fed to the line oscillator.

WHY BOTHER?

By lowering the conditions back to normal in a fashion which is symmetrical for odd and even fields, line oscillators which may tend to drop synch. are led smoothly back into step.

This makes plausible reading but ignores two rather obvious factors.

Firstly, if a line oscillator is likely to drop synch. during the passage of a frame pulse interval, it is just as likely thereafter to lock on to the wrong half-line pulse, making the cure worse than the complaint.

Secondly, why bother about lowering the separation circuit conditions systematically back to normal? Why not allow them to revert to normal as quickly as they will, so that the line pulses will recapture the oscillator by brute force? After all, the blanking period should be amply long enough for this to happen before the trace again becomes visible.

And that about sums up the arguments which have been put to me during the month—none of them sufficiently precise or obvious to make one lay aside the pen and exclaim (with rapt delight). "Why, of course!"

TEXT BOOKS

During the month, also, I've kept an eye on all the text books which might give the required clue but, again, to no avail.

In their otherwise helpful book, Television Servicing, Heller and Shulman appear to get out from under in the traditional fashion.

After a very clear explanation of the pre-equalising pulses and their relation to the integrator charge curve they say:

"The equalising pulses that follow or lag the vertical synch. signal help maintain an equal discharge condition in the integrating network for the odd and even fields. The charging curve becomes the same for both fields and the vertical oscillator is maintained in correct synchronisation. Satisfactory interlacing is thus assured."

Yes, but how? Why?

Similarly Grob's Basic Television, which is being used fairly freely around the place as a reference book, explains the pre-equalising pulses and adds:

"The six equalising pulses that follow the vertical pulse minimise any difference in the trailing edge of the vertical synchronising signal for even and odd fields."

Pourquoi? (I'm tired of saying "why" in English.)

In fact, I'm beginning to tire of the whole business.

Even the CIB has its file of unsolved cases.

I'm becoming horribly suspicious that we've been trying to build a case around circumstances that could have a very simple explanation. Just consider these points:

(1) Post equalising pulses were not provided at all in original British Standards. It is difficult to reconcile this with oft-repeated statements that the pulses are essential to the operation of various (but unspecified) old-style time bases.

(2) Writers and contributors have claimed some relationship between the post synch pulses and particular time bases but no one has come to light with a convincing and precise explanation beginning, "Here is the circuit and the reason . . ."

ACTUAL TESTS

I have heard "second-hand" of tests made with a variety of local receivers and their reaction to the addition or subtraction of post synch pulses to the input signal. None of them showed any reaction.

(3) Station equipment must be capable of inserting half-line intervals into the final video signal and, according to one local station engineer, it is only a matter of adjustment to extend the time cycle so that post as well as pre-equalising signals are radiated.

(4) From another local station engineer, I have gathered that post synch pulses are significant in their own internal instrumentation. In checking the accuracy of their interlace, it is important to have a completely symmetrical integrated waveform on both fields, so that their position and magnitude can be compared.

This last at least makes sense.

If the post synch pulses can be put in without difficulty, it would be logical enough to write them into the standards so that a completely uniform integration pulse would be produced for both fields.

But here's the vital point: The need for such precision would be confined to station operating, instrumentation and checking.

The idea that it has any bearing on the operation of practical receivers may be a complete "furphy".

At least it would explain why a couple of dozen authors and contributors have failed either to explain or agree.

POST SCRIPT

A few hours after writing the above, I discussed the problem with an engineer from one of our big local TV development Labs. He didn't know the answer but said he'd make a search.

Next morning he rang to say that Deutch in his "Design Of TV Receivers" (p. 15) makes a definite statement on the point. He says, in effect, that post equalising pulses are useful only for signal checking purposes and play no part in the operation of actual receivers.

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OFF THE RECORD — NEWS & REVIEWS

Do tempos change with the times or are they part and parcel of the score? How fast is a Scherzo? If a man can play a given passage more accurately and cleanly than another, should he make that an excuse for doing so, even if he is his own authority for it?

by John Moyle

hese are music's 64-dollar questions, ver there were such things.

nd they are becoming more and e pertinent as we listen to modern rded performances of the classics. the moment, they are perhaps the material about which to consider matter.

peed of execution and speed of ght are relative things. There isn't question that both have enormously eased for most of us in the past 50 s. If, in our everyday life, "slow" bout twice as fast as it was for idpa, then shouldn't "Adagio" be ded up as well?

's interesting to note that it is gen- ly in places where this quickened po of life is most noticeable that tendency to play music more quickly ound.

may be very hard to carry this ght too far, for no one can deny although many composers did not k definite speeds, and some latitude demonstrably allowable, there is to t people an optimum speed apart n which the music itself loses charac- and begins to be something else.

Despite all things to the contrary, n that happens the danger point has n reached.

There is no time to examine this ier interesting and controversial point ther at the moment. It came to my nd because several records this month w marked differences in both mental l physical tempos, with corresponding erence in the impact of the music.

BEETHOVEN — Symphony No. 3 in E flat major (Eroica), Opus 55, played by the Berlin Philharmonic Orchestra, conducted by Eugen Jochum, DGG18179 LPM. Played by the Philharmonia Orchestra, conducted by Otto Klemperer. Columbia 330CX 1346.

Judging by the frequency with which ferent companies issue records of the ne work at the same time, one would agine they did it on purpose.

This makes it a bit tough for a re- wer who is therefore forced into mak- a comparison — if not a recommen- ion — when often he would rather t.

To a certain extent, this is so with se two Eroicas, for they are both good different reasons.

And to them must be added a per- mance of the Berlin Orchestra under n Kempen issued some time ago by ilips. Of the six versions I now have, se three contain the best of the sym- ony.

Klemperer's version it is very hard leed to criticise. It is the most recent cording of the three, and it sounds like

The Philips disc is full and powerful; DGG has a spaciousness to it, al- ough the sound is a little tubby when rectly compared with the other two.

But the Columbia has the best of both, and more. True, after a few bars, all three sound good, but there isn't much doubt on a quick changeover basis.

That Philharmonia balance is mighty hard to beat these days for music of this type.

Musically, Klemperer again is very fine. The virtues of this conductor may be receiving somewhat laggard recognition, but here you will find he is not only able to sustain the continuity of this great work at perhaps the slowest permissible pace, but at the same time he attends to the score with great scholarship and discretion. His effort comes closest to the real Beethoven.

His tempos are slow. Some will prefer those of other conductors, but they must take in exchange a performance less truly heroic.

Van Kempen has the liveliest and most vigorous version of all, and if it isn't the most profound, many will find it the easiest to listen to.

In all three there are spots which continue to disappoint. That strongly built climax about half-way through the first movement hasn't yet been done quite to my liking, except, if I remember, by Toscanini, whose sonics are now too far down the slope. No one has to my mind solved the problem of the speeds in the Scherzo, although Jochum comes very close to it. Kempen, strangely enough, takes it slowest of all — his metronome must have been wrong!

But I'd say that, no matter how you like your Eroica, one of these three discs will give it to you.

If I was forced to it, I'd have to choose Klemperer, who really has produced a fine disc. And strongly in his favor is the fact that he is the only one who doesn't split the second movement. To me, that's worth a great deal.

RACHMANINOFF — Concerto No. 2 in C minor for Piano and Orchestra, Opus 18, played by Clifford Curzon and the London Philharmonic Orchestra, conducted by Sir Adrian Boult. Decca LXTA5178.

At last there comes a recording of this concerto in which the piano and orchestra strike something like the optimum balance.

I have been complaining with monotonous regularity about a number of quite good efforts over the past 18 months in which the soloist was much too forward.

Whole pages of this work demand that the piano becomes part of the musical texture, merging and contrasting with the orchestra in a most particular and peculiar way, and without which that essential rhapsodic flavor is completely lost.

I give full marks to Curzon and Boult for this, and maybe to the recording engineers who either agreed with them, refrained from spoiling their good work, or who perhaps talked them into it. It would be interesting to know.

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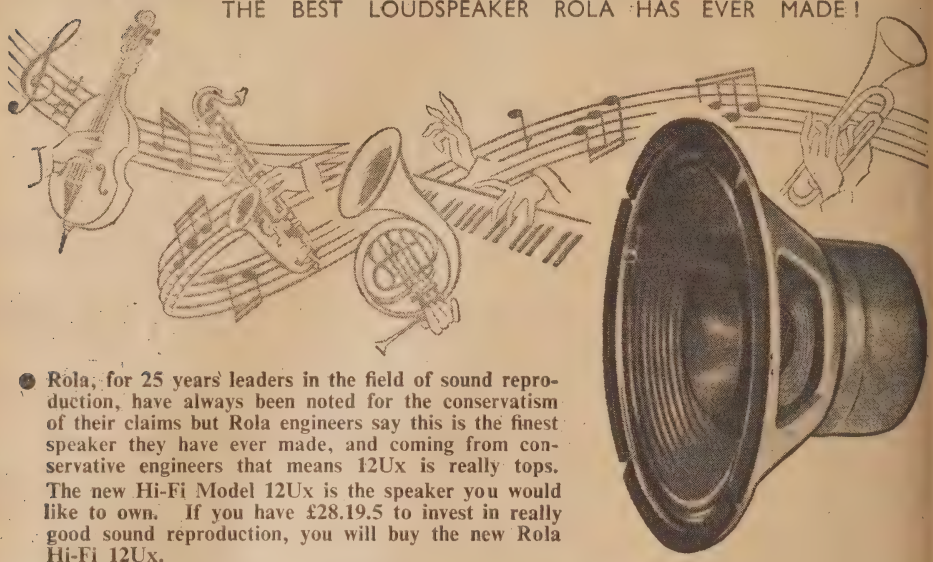

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any rate, I listened to it with the st of pleasure, and strongly advise e who decides to play the concerto likewise.

will, with me, agree that this good ork makes up for some of the de- es from perfection which are the n of every record.

the main, these are the result of neticulousness from both Boult and n.

1 can hear this in the second move- particularly, and in parts of the

essential ingredient in this concerto outhful impetuosity, firstly to guard t languishing in the long passages, econdly to give a natural warmth melodic line.

only criticism is that this ingredi- s sometimes missing — its very ity seems to have lessened its enter-

was almost unpardonable to slow e finale of the last movement, as is here. It should exult, it is an emo- outburst of great significance to hole work.

tead, the music, by contrast, be- s stagey and pretentious.

e recording is very good, and well the modern average. It is vastly ent from the Istomin disc reviewed month, which was as much over- erant as this one is under. Aren't ard to please?

PROKOFIEV — The Love of the ree Oranges Suite Opus 33a, yed by the London Philharmonic rchestra; Lieutenant Kije Suite, us 60, played by l'Orchestre de la ciete des Concerts du Conserva- ire de Paris. Decca LXTA5119.

CHAIKOWSKY — Nutcracker ite, played by the Philharmonia rchestra, conducted by Nicolai alko. HMV OCLP1060.

ere is a story that the Czar Paul I ead a phrase in a report which he ght referred to a Lieut. Kije of his y. Rather than correct the Czar n he asked about the man with the ge name, the army invented a ficti- tious character who had to be born, fall in love, get married and die like anyone else. This music illustrates such phases in his existence.

Obviously the music has a serio-comic flavor to it, which must be preserved and exploited. It is quite a subtle piece of ironic absurdity mixed with a gentle pathos concerning emotions which, never really true, had to be truly experienced just the same.

It is not enough to display merely its clever and at times unique orchestral skill and color.

Boult does well enough, but does not reach the superlative standard of Scherchen's Grand Prix disc of 1953.

This record has few equals in its clear registration of instruments and their combinations, and in the conductor's unerring feeling for tone color and tempo.

The last note of the first movement, for instance, in which the cornet is supported by drums and an extraordinary collection of strings, is crystal clear on Scherchen's Westminister, but almost lost under Boult.

To the latter, by comparison, I could allow only a good concert standard.

Concerning the "Three Oranges", Malko gives a consistently brisk performance, much m re lively than Boult's and never more so than in the opening section.

It would be dangerous to discount the Decca on this point, however, as opposed to Malko's vigor and clean precision there is more spectacular recording with Boult, although in this respect they are both above average.

Boult also includes the 6th and final section which Malko apparently couldn't fit into his disc — probably a comment on the degree of variable grooving used with each.

Malko's Nutcracker, lacking a little in zest, is straightforward and reliable, no theatricals or surprises. It hasn't the brilliance of the full Mercury set, and is a good contrast to it in the British style of recording. The standard full Suite is played with which most of us are familiar.

Both surfaces are excellent.

EMPFF BRINGS HIGH-CLASS TO BEETHOVEN

BEETHOVEN — Concerto for iano and Orchestra No. 3 in C inor, Opus 37, played by Wilhelm empff and the Berlin Philharmonic rchestra, conducted by Paul van empen. DGG 18130 LPM.

's strange, but there aren't many re- ings of this concerto. Strange, be- e it is a lovely work — tuneful, y, clean and tight in construction, a worthy companion to Nos. 4 and

he competition, therefore, isn't severe, it would need to be if this disc were e overshadowed.

empff has not been heard to better antage. He treats the music with full ect, but is never afraid of it. The movement is possibly the best. Its po is brisk but not hurried, it has lity but no hastiness, there are truly sical lines to it with no trace of viness or pomposity.

have been waiting a long time to r it played so well.

he first movement cadenza is new to but the touch is right and the orch- estra's re-entry at the end is handled to perfection.

Some warmth seems missing from the slow movement, although it is hard to say just where. The orchestra could have shaped its part more smoothly and the piano could have merged more graciously with it.

There is something like diffidence, too, in the opening bars of the last movement, which should have contrasted more effectively with the reminiscent mood of the second. This seems strange in the light of the good team work in the first movement. There is too much sameness in the treatment of the various sections, at least in the first half.

The piano recording is first-rate, except for a few notes near the end, and these are minor lapses from perfection. There is a good body to the orchestra, and well-judged reverberation to the occasion. The recording amplitude is not high, but with a quiet surface this simply means a slightly increased gain setting.

I have no hesitation in advising this as the version to have, and in fact, in nominating it as the month's safest buy.

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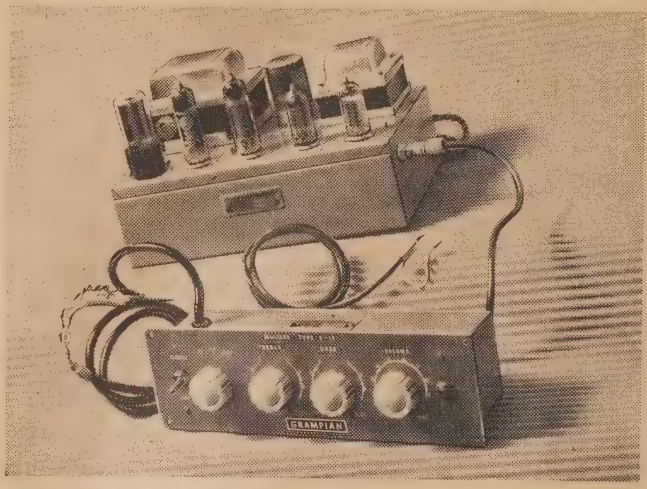

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MENDELSSOHN — Concerto or Violin and Orchestra in E Minor, pus 64. Played by Igor Oistrakh nd the Leipzig Symphony Orches-a. Conducted by Franz Kon-itschny. DGG LMP 18329.

is something quite unusual for father son to achieve world ranking at the e time as concert violinists.

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t is unlikely that Igor will ever com-e with his father, because he is a tly different type of player, although ery fine one.

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The Wieniawski is the better side. It sts exactly the violinist's style, ear for lody and his present stage of develop-nt.

The Mendelssohn is lyrical but too ht in weight. He could have touched s music more deeply. The second vement is played too easily and brisk-l the tempo is too even. There isn't ough variety in it.

Igor is best when the going is hard-e.

One thing he has in common with his her — his intonation is faultless.

It's a very good disc. General sound typical of DGG.

CHOPIN — Polonaises Nos. 1 in C Sharp Minor, 2 in E Flat Minor, 4 in C Minor, 5 in F Sharp Minor, 7 in A Flat Major and 9 in B Flat Major. Played by Stefan Askanase, pianist. DGG 19064 LPEM.

I haven't heard this pianist before, but few bars were enough to reveal that has the genuine Chopin touch, and e Polonaise touch at that.

Chopin's use of dance forms — altz, mazurka and polonaise — was ten a free one.

For him they set the style which he lowed himself to adapt and exploit cording to mood. On them he built me most imposing and pianistically portant edifices with that kind of suc-ss which is limited to a "pianist's com-oser".

This happens more than once in the olonaises — the F Sharp Major, for ample, is large enough to accommodate complete mazurka in its centre sec-on.

But they all require a special air of dignity and heroism quite different from the waltzes and mazurkas.

There is good variety in this disc which includes the Opus 61, the last big piano work which Chopin wrote.

In all these Askenase shows his high class. He is never flashy, he does not belabor the keyboard in search of weight, he does not drool or languish, he plays always with great sincerity.

His dynamics are well controlled, his big tone is full, he is deft and well-shaped.

The piano tone if anything favors middle and lows, sometimes the right hand fails to come through as it should, although this may be partly the fault of the pianist.

But the style is there, and the shape, and the beautifully-handled tempos. This, I thought, some of the most satisfying Chopin heard for some time.

No surface noise. Recording amplitude is not high, but technically it is extremely good.

MANUEL DE FALLA—El Amor Brujo, El Sombrero de Tres Picos. Played by the Berlin Philharmonic Orchestra, conducted by Fritz Lehman. DGG 19044 LPEM.

We rarely hear brilliant music today which is not in some degree exploited to provide a spectacle of sound, if I can so mix a metaphor.

There is restraint in this playing but no lack of color.

El Amor Brujo contains some vital and brilliant orchestration, including the Ritual Fire Dance, which has been translated into many musical forms.

But the Berlin orchestra concentrates on the music first—not a single note has been sacrificed for show.

This normalised treatment will fascinate you, for it allows full development of the intricate rhythms and tone contrasts.

GYPSY SINGER

El Amor Brujo impressed me particularly this way—maybe I am biased for I saw this ballet at La Scala and its dramatic power struck me with great force.

It's a pity the jacket notes haven't made more of it.

The voice of Diana Eustrati has a suitably dark and husky tone. This is almost completely gypsy music, the tale of a ghostly lover who comes between the gypsy girl and her man. Falla has rarely written a more attractive score.

The three-cornered Hat Dances are in quite a different mood, and several are bound to be familiar.

There is a marked difference in the sound of the disc as compared with the average DGG. It has an extra vividness and range about it which points to a change somewhere in technique.

It has a fine combination of detail and powerful, reverberant sound, admirably suited to the hot flush of the Spanish idiom.

It is the highest-fi DGG have given us so far.

Only on the heavier and lower frequency passages did I think the sound open to any criticism—even here it is not a really safe point to make for much of the score is intended to be rough and strongly-bowed.

It's a fine record.

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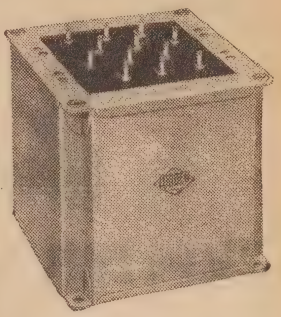

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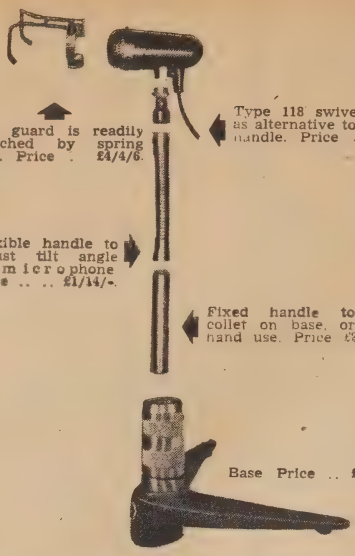
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TWO OUTLOOKS DIFFER IN TCHAIKOVSKY

TCHAIKOVSKY — Piano Concerto No. 1 in B flat minor Opus 3. Played by Shura Cherkassky and the Berlin Philharmonic Orchestra conducted by Leopold Ludwig. DGG 18 013 LPM.

Played by Julius Katchen and the London Symphony Orchestra conducted by Pierino Gamba, with Liszt's Hungarian Fantasia. Decca XTA 5164.

You will choose between these records as a direct indication of how you like to hear the concerto played, for they are vastly different. At least you will have this consolation, that, whichever you pick, it will be the best in the field.

There are some who rate this concerto as a masterpiece, a thing of moods and colors, of romance and display, to be worked over, delved into and given the full treatment.

These people will like the DGG record, for I doubt whether anyone could bring more from the music that does Cherkassky, or to do it more competently.

He has prepared and presented the work with the greatest diligence.

Others do not think this is a very good concerto, and certainly not one which stands up well to examination and dissection either in treatment or in structure.

When they do listen, they like to hear it handled vigorously, primarily as a show piece, its brilliant passages allowed to scintillate, its romance treated full-bloodedly. They are particularly on the lookout for any signs of a schmaltz.

This in general terms is Katchen's outlook. He produces a taut, well-shaped performance, full of vitality, stimulating, and as interesting as it can ever be.

Decca have summed up his attitude very neatly on the cover note—"it is music of far flung eloquence or it is nothing."

Cherkassky will seem unduly pretentious to these down-right folk, chasing effects along side-tracks to the detriment of the whole (and finding them very beautifully, too), loading phrases with a significance they cannot sustain.

They might even say that the music tends to sag in the middle.

I could go on, but with little profit I fear, for there is no half-way viewpoint about how this concerto should be played.

For myself, I would choose Katchen, because I see this work heroically as he does.

The Hungarian Fantasia is an extra for Decca. It illustrates the brisker pace of Katchen and its good performance is worth having for no extra cost.

On the jacket, Decca say that the sound on this disc is a new standard of perfection, never before achieved.

It is different, and good, too. It has a conviction about it, the sound is balanced and extremely clear. Definition isn't a matter of exaggerated highs or exaggerated anything. There just isn't any curtain between you and what goes on.

The piano tone is excellently reproduced, good enough for me to wish it had been a better instrument, and free from a clanginess on hard passages.

And it's quite free from any hint of oppression no matter how loudly the performers are playing.

DGG's sound is vastly different. By comparison it is rather thick and woolly, it has a round, romanticised quality about it which is very much in keeping with the way the music is played.

Both discs are extremely quiet and free from any distortion. Not often do we have two simultaneous releases of such all-round high quality.

BRAHMS — Piano Concerto No. 2 Opus 83. Played by Rudolph Serkin and the Philadelphia Orchestra, conducted by Eugene Ormandy. Coronet KLC 549.

Mostly this is a high pressure version of the concerto, or should I more accurately describe it as a highly pressurised version.

This pressure isn't merely a matter of tempo or a sense of hurry — it's a way of thought so often found in America. The whole performance is cite closely miked, which gives extra point to this overall result.

I had the impression, in the first movement at least, of a most competent orchestra and pianist both determined to ram the music down my neck whether I liked it or not!

Maybe these are hard words, but the total effect was as much one of efficiency as of music.

The Philadelphia Orchestra plays superbly — its strings have reached the stage where they are not only unanimous, they are extensions of a single instrument, in tone and style, which I found color-less.

One requires quality in first-class violins, but their subtle differences in line are the things which give to the string section most of its beauty.

Lack of color is accentuated by a dead studio which seems to rob the orchestra of its full stature and to accentuate the top register which I found it best to subdue.

Serkin has plenty of power and ability to cope, but he was too close to me

Now you will see I am one who likes a more classical and possibly old-fashioned air to my Brahms. If you are more down to earth you will like this disc, particularly the final movement, which is quite good. You'll like its clean surface, too, and the convincing instrumental tone.

So don't condemn it too quickly just because I thought it rather slick.

STRAVINSKY — The Rite of Spring, played by the Minneapolis Symphony Orchestra conducted by Antal Dorati. Mercury MG 50030.

If by this time you know the kind of performance Dorati and the Minneapolis Orchestra can produce, you know what to expect from this record.

The sound is the predominating thing, so much so that you may find it difficult to concentrate on anything else.

I doubt whether any orchestra today is better able to play music which calls

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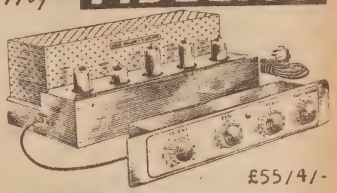

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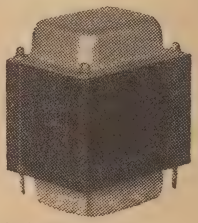

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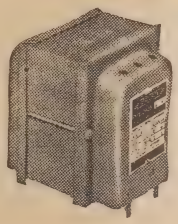

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he free and individual use of ments.
h Dorati, it has become almost a r of honor that no single note d be lost.
: Rite is an extraordinary piece of and no one could play it with- considering how he should exploit core. Those wild musical con- unusual registers of many instru- s, and violent harmonic clashes written to be heard.
e danger is that they will dominate thing.
all events, I think that Dorati fell solidly for the temptation, and produced as fine a demonstration d as you could find.
spite the greater frequency with dramatic discs are heard days, the last side particularly will astound you.
you see greater depths in this n picture, and such depths were ubtedly visualised in the ballet that ne ever stages, you will find it tilt to keep the program in mind t all these things are leaping at from the loudspeaker with a realism impact that are almost shocking. it's just the music you want, have ner look around. But if you want ow just how brilliant it can sound, I know all about it when you played this disc.
brief—a showpiece.

BELA BARTOK—For Children ol 2. Slovakian folk-songs played Geza Anda (pianist). Columbia 30CX 1316.

hese lovely folk songs, played so rbly by Geza Anda, are most wel- e.

Bartok in the years 1908-9 wrote about 80 piano settings of folk songs, half Hungarian and half Slovakian. This record contains the latter, which number 39.

Bartok's idea of a setting was essentially to avoid the standard method of fitting all music to the same scales, and conventionalising the tunes to the inevitable detriment of their individual character.

His intention was to allow the setting to grow out of the tune itself, of its natural idiom, harmony and tempo.

The result is obvious from the very first note. There is a directness, a simplicity, a clarity in the appeal of each which succeeds in transforming the simplest of them into a work of art.

It goes without saying that many are more successful than others, but they are all touched with the same challenging and intriguing air.

Should children really use these things in their teaching? Why not? It's true I think that not all youngsters will find the extra subtleties easy to comprehend, but they would be a grand antidote to the habit of thinking in terms of the diatonic scale which generally conditions beginners all through their most formative years.

And Bartok certainly meant them to be so used, for they are mostly easy to play and quite short.

This is Volume 2—it seems that Volume 1 would be the Hungarian songs. Let's hope we get them, too.

I've already said that Anda plays superbly—so he does. There is little opportunity for brilliant recording, but his crystal clear touch and gracious tone come clearly through a quiet background.

Why not try this one on your children? You might get a shock!

MOZART — Piano Works Vol 8; Nine Variations K264, Sonata In G major K283, Sonata in D major K576, Ten Variations K455

Vol. 9; Sonata in F major K332, Eight Variations in A major K460, Sonata in C major K545, Twelve Variations in E flat major K345, Fantasy in C minor K396. Played by Walter Gieseking. Columbia 330CX 1345, 330CX 1358.

It is impossible not to be impressed with the musical sincerity and beauty of these records.

Into them Gieseking has striven to bring grace, simplicity charm and clarity.

His formula is successful many times, but I could not help feeling that on other occasions its very consistency was its downfall.

His general approach to Mozart is a small one, that could almost be called restricted. I have the feeling that he has a little list of all the things that Mozart should be and not be, and that his hands keep them in order, like a little mouse on the keyboard, that must not be allowed to run away.

Inevitably there comes a work where this isn't a very successful treatment — the music needs a change of atmosphere, of pace, of air into which to grow.

It may be, too, that after such superlative sets of Ravel and Debussy, one comes to expect the same standard all the time.

He doesn't make many demands upon the piano, and it has responded by producing a pleasant and appropriate tone

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SHORT-WAVE NOTES BY ART CUSHE

PHILIPPINES EXPAND DEFENCE NET

Latest information reveals that extensions have been made to the Defence Network in the Philippines, and that new stations operated by the Defence Administration are receivable in this part of the world.

THE stations of the National Civil Defence Administration were verified on 3305 and 3365 Kc. last March, and these transmitters have had two other stations added. The present network is DZCA on 540 Kcs 1 Kw. and 3305 Kcs and 5970 Kcs in Manila. Iloilo operates on 3365 Kc and Mindanao uses 3292 Kcs. The stations operate 7.00 pm-10.00 pm on 540, 3292, 3305 and 3365 Kcs. The program consists of national music at 7 pm. news in English at 7.45 pm, 8.00-8.30 pm Tagalog music and Bureau of Lands Rondalla; news in Tagalog at 8.30 pm; US Embassy tape recordings at 8.45 pm-9.00 pm; Civil Defence talks with music from 9.15 to 10.00 pm.

The station should be addressed as National Civil Defence Administration, Independence Grandstand, Luneta, Manila. This Government-operated station is directed by Alfr. G Eugenio

There are also Swedish, Dutch and Danish transmissions.

On the other hand without neglecting works of lighter vein, good classical music is always one of the main features of Radio Brazzaville.

Radio Sweden

A NEW service of Radio Sweden which is now in operation has resulted in the retiming of some of the transmissions. The new schedule is:

10.30-11.45 pm on 11880, 15240 Kcs to Far East.

Midnight-12.30 am, on 17840 to East Coast of North America.

12.45-2.00 am on 15240, 17840 to South Asia.

2.15-3.30 am on 11705, 17840 to Middle East

3.45-5.30 am on 17840 to Africa.

6.00-6.30 am on 7210 to Europe.

6.45-8.45 am on 11705 to Europe.

9.00-10.30 am on 1178 Kcs to Europe.

9.00-10.30 am on 9620, 11705 to South America.

10.45 am-noon on 11810 to East Coast, USA.

10.45 am-1.00 pm on 11705 to South America.

12.15-1.30 pm on 11810 Kc to West Coast of North America.

1.45-2.30 pm on 11810 to Central America.

Sweden Calling DXers will now be broadcast every Monday-Tuesday as the last part of the English transmission.

Radio Brazzaville

A NOVEL folding verification has been received from this French Equatorial African, with information about the broadcasts and the country from which the transmissions are made. Brazzaville confirmed our reception on the new 15450 Kc frequency which has been heard at fair strength to 5 pm. This new channel is proving a good channel here and to give better 25 metre coverage the frequency in this band has been moved to 11975 Kc and is clear of the severe jamming on 11965 Kc.

Radio Brazzaville was set up in 1940 as the Voice of Free France. In French Equatorial Africa, having rallied to General de Gaulle in August, 1940. It was brought up to its present size in 1943 when it brought hope and consolation to millions of Frenchmen in the occupied Motherland.

Special notice must be made of the Morse operators who day and night pick up Press telegrams coming in from all parts of the world. The station has indeed always attached great importance to detailed and reliable information dispensed in numerous news bulletins, in French, English, Portuguese and Spanish.

Radio New Zealand

A NEW schedule now in use by Radio New Zealand includes the dropping of 17820 Kc to Australia and the use of 15280 Kc to this area.

To Australia: 6.00 am-4.40 pm ZL4, 15280 Kc 4.55 pm-close down, ZL2, 9540 Kcs.

To Pacific Islands: 3.00-5.30 am, ZL3, 11780 Kcs, 5.45 am-4.40 pm on ZL4, 15280 Kcs. 4.55 pm-close down on ZL7, 6080 Kcs.

Present sign off times are 8.45 pm week days: 9.20 p.m. on Saturday, and 8.00 pm on Sundays. News broadcasts are at 4.00 am (BBC news), 5.00 am (BBC news, recorded), 6.00 am (BBC news), 10.33 am (NZ news, Monday to Friday), 4.30 pm (BBC news recording), 6.30 pm (NZ news, Monday to Saturday), 8.30 pm (NZ news, Monday to Saturday).

Radio New Zealand welcomes correspondence from listeners, and values comments on programs. The engineers are interested in reception reports from listeners, and all reports are acknowledged by letter or verification card. Reports should include frequency used, date, time, and details if any of interfering stations, as well as program material. Reports should be sent to the Director, Shortwave Service, NZBS. Box 2396, Wellington.

Notes should be sent to Arthur Cushen 212 Earn Street, Invercargill, NZ. All times are Australian Eastern Standard

Publication Review

WORLD RADIO HANDBOOK, published in Denmark by O. Lund Johansen. The 1957 edition of the World Radio Handbook is a fine publication. Excellent in content and very well produced, it contains the information about every radio station on shortwaves, and most of the medium wave stations. It has over 170 pages, crammed full of the information the listener needs—in fact shortwave listening would be dull without the aid of the book.

Stations are listed by country, with details on time zone, addresses, leading personalities, stations, frequencies, schedules of news and foreign language broadcasts, interval signal, verification policy and future plans.

A world time chart, list of stations by frequency, and world television stations are included. This 11th edition also contains maps of the areas, with location of stations shown and is illustrated with many photos of radio stations and personalities.

New Zealand listeners should write for fuller details to Arthur Cushen, 212 Earn St., Invercargill, NZ.

Australian listeners should write to Miss Dorothy Sanderson, 23 Elizabeth St., Malvern, Victoria.

MANILA TO USE 21515 Kc

The Far East Broadcasting Company in Manila has been assigned 21515 Kc. for the new 13 metre outlet which is now expected to take the air in May. The aerial system is to be west-east. Changes in the power of the 17805Kc. transmitter have been made. This station now operates with 5000 watts, to be increased to 10,000 watts when permission for the use of higher power on the channel has been granted. Mr Norman Blake of the FEBC is planning a special programme on the broadcast band station DZFE, 1030 Kcs for listeners in this area. This is arranged tentatively for the morning of Saturday, June 15th from 1.00 am to 2.00 am. A special verification card is to be issued to all who report reception, of this station, as yet unheard in this area.

FLASHES FROM EVERYWHERE

INDIA has added a new shortwave mitting station in the Northern Regio vice, the station being located at Bhopa station operates as follows: 11.30 am-3 on 5990 Kcs; 10.00 pm-2.00 am (Sun 3.30 am) on 4940 Kcs. News in En broadcast at 12.30 pm and 1.30 am. Simla station is now operating on 4760 K noon-1.00 pm and 10.00 pm-1.45 am (to 3.30 am)).

JORDAN has added a new transmitter capital Amman, which has been broadca the Jordan Broadcasting Service since Jan Amman operates 12.30-3.30 am on 6045 Arabic. Jerusalem operates on 6521 Kc 4.30 pm, 9.20-10.00 pm (English), 10.0 11.00 pm (Arabic), 3.00-7.00 am also in

HAITI station Radio Commerce broa from Port-au-Prince, has commenced o on a new frequency, 5955 Kc. The s schedule is 9.00 pm-12.30 am on 948 8.00 am-1.30 pm on 5955 Kcs. On Sund schedule is from 9.30 pm to 10.00 am on 9485 Kcs.

CUBAN transmitter on 5085 Kcs ha identified as broadcasting from Havana 9.00 am to 3.00 pm. The station relays Reloj de Cuba, and CMW. Another COBZ is again being heard on 9020 K the transmissions are irregular and hav heard to 3.00 pm.

TAIWAN transmitter BEC27, broad from Taipeh, has been heard with muc ter strength in this area, and in North A The broadcasts are on 7240 Kc. and are American Armed Forces Radio Service. information is that the transmissions a shortwave only on Saturday and Sunday on medium wave on other days. The has been verified by us with a letter card. Increase in strength may be due new power which the station has been aut to use, increasing to 1000 watts while new equipment was also to be installed.

SUIDIAN ARABIAN BROADCAS SERVICE, which is being received at fair s in the morning, has verified a New Z listener, with the news that the present sc is: 1.30-2.45 pm, 9 am-11.20 am, on 597 3.00-5.10 am also on 5970. The transmiss the mornings is also radiated on 39 Riyadh), 6175 (to Egypt), 6100 (to Sudia Arabia has no standard time, b hour periods commence at sunrise, w o'clock being one hour after sunrise, s sunrise at 6 am when it is 7am local is then known as 1 o'clock. The broa which come from Djeddah therefore differ day to day.

BRAZIL has been heard in Sweden whe transmissions have been carried on ZYK32 Jornal de Commercio in Recife. Tests have heard on two new channels, 6.45 a 1700 Kc and at 6.00 am on 11990 Kc, the station has been heard on 9790 Kc.

ALBANIA has a new station, Radio Stalin, which opens daily at 2.00 am on Kc, and has been heard in Europe to 4 am. Radio Tirana now broadcasts in E at 6.30 am on 6815 and 7850 Kc. OMDUR transmissions on 5010 Kc. have been heard strong signals with the usual English session mencing at 2.00 am. The station was noted to after 5 am when strength is still of the strongest in the 60 metre band.

BRAZZAVILLE is being heard in V signing off at 5 pm on 15450 Kc, reports Morris. We are hearing another outle 9385 Kc with news in French at 4 pm. S are fair in New Zealand, but a whistle o frequency makes the signal below standa

SALISBURY transmissions from So Rhodesia, have been verified by Cyril And Mount Hawthorne, WA, with the inform that the transmitter uses 7500 watts. The s operates on 7285 Kc and operates 3.00-4.0 7.00-10.00 pm, 1.00-6.30 am week days, Mo the sign off is at 6.00 am.

BRITAIN will commence Summer Tim Sunday, April 14, and listeners will find timing of transmissions from some countrie listeners in the United Kingdom will ma change. Radio Australia plans to alter missions to 4.00-4.30 pm. PARIS is now w ing all reports with a new verification card ac ing to reports from European listeners. This w welcome news indeed, as for many years to Paris in the many transmissions we have gone unanswered, yet the station has seeking listeners' assistance in regular issu questionnaires. English is broadcast from on 7240 Kc (English midnight-1.00 am); we will enjoy better reception in the sessio 6.00 am on this channel.

THE HAM BANDS WITH BILL MOORE

Tara, the mid-February cyclone, which wandered up and down the coasts of Queensland and N.S.W. saw the VKZWI Amateur Emergency Net alerted with the possibility of flooding on the lower North Coast of N.S.W.

FORTUNATELY the floods did not reach serious proportions and amateurs were able to return to their daily chores.

However, another section of the WIA was during the cyclone period when members of the VHF section of the NSW Division ...ed to Barrington Tops north-west of New-

...trip was made at the request of the ... and Rescue Section of Federation of ...Walkers Clubs to provide communication ...the search for a missing party of nine ...likers who were three days overdue on a ...ay trip.

...iously the VHF group had co-operated ...e search and rescue section in a series of ...to demonstrate the value of lightweight ...equipment in bush rescue work.

...trip of 170 miles was made by Horry ...ne, VK2HL, and John Miller, VK2ANF. ...rovel all night to reach the Tops.

...t took with them four crystal controlled ...talkie 144 Mc units and a base station, the ...being installed at Barrington House where ...oprietors fed all the searching parties.

...s were given to searching parties and ...he lost party was located other searchers ...recalled by means of amateur radio. The ...le equipment operated successfully but the ...n of a skilled operator to each party ...u have assisted the search generally.

...ally the party of nine persons, which in-...e two girls was not lost but could not ...at any speed due to the heavy mist and ...conditions.

...A searchers including the police who were ...er in force were impressed by the value of ...adio equipment provided by the group ...d he assistance that could be rendered by ...communication.

★ ★ ★

BIG VHF HAULS

...TE a burst of enthusiasm on the VHF's ...n NSW was recorded when news was ...d that contacts with New Zealand should ...ssible on the 144 Mc band during the next ...months.

...It was in 1951 that Allan Llewelyn, VK2AH, ...ted ZL3AR and Clem Tilbrook, VK5GL, ...d Colo Everingham, VK6BO, worked. Both ...e contacts were close to the record of 1400 ...s for the band, a record that, incidentally ...l stands.

...Reports available seem to indicate that the ...U will reach a very high figure in March ...d April and that contacts with ZL's could be ...ble around midday on 144 Mc due, presumably to sporadic E reflections.

...The southern States in February 144 Mc ...al opened and one contact between VK7PF ...unceston and VK3ATN in Birchip, over 400 ...l produced S9 signals both ways. Many ...h contacts across Bass Strait were recorded ...d number of Z call amateurs worked their ...s DX.

...At the time of writing full details of the ...ngs are not available but it was reported ...a VK3 to VK7, VK3 to VK5, and VK5 to ...K QSO's were recorded, and a VK5 to VK7 ...t was also rumored.

★ ★ ★

NSW DIVISION MEETS

...s usual the February meeting of the NSW ...division of the WIA was handed over to ...e VHF group who presented an introduc-...to the VHF's. VK2APO Group President ...ered the presentation. Bob Winch, VK2OA, ...wed VHF receivers, comparing their con-...ction with normal HF units, he also discussed ...t antenna, a number of converters were ...n around for inspection.

...transmitting side was explained by Bob ...icey, VK2ZAR, who pointed out the re-...irements for successful transmitter construc-...n. Equipment was displayed including a 100 ...co-axial tank 4 x 150 for the 144 Mc band ...recording and color film of the group's ...ity at Jenolan Caves with the Speleological ...ociety was then presented. A further film of ...n with the Bushwalkers Clubs was not shown ...e to the intervention of the caretaker—time ...close.

...ther general discussion it was decided to vote ...additional £300 to complete the present ...ilding at Dural for VK2WI. The VK2WI ...ansmitters should be operating from this QTH ...April with sufficient power to ensure effective ...state-wide coverage.

North Coast Convention

URUNGA will again be the location of the North Coast WIA Zones' Convention to be held over the Easter weekend, Saturday, Sunday, Monday, April 20, 21 and 22.

Actually the event will commence on Friday night when amateurs will discuss general topics in the lounge of the Ocean View Hotel. Registration will be made at the same venue on Saturday. The first field event, the Gerry Challender Memorial contest, will be conducted from 3 pm to 5 pm on the 7 Mc band.

The event is for portable or mobile equipment. Telephony or CW may be used but gear must not be connected to the AC mains.

At 8 pm films will be shown at Crieff. VK2XO's "Do Me" shack with usual 807's in parallel—push push on display.

Sunday morning will see the 144 Mc Hidden Transmitter search conducted at 10.30 am. At 3 pm the Urunga Scramble will commence and stations may operate on any band, with any power from any source, for the contest period of one hour.

During Saturday and Sunday heats of the 144 Mc Blindfold Hunt will be run as contestants present themselves. XYL's and junior operators will be competing.

It is essential to book accommodation as early as possible direct to the Ocean View Hotel or Pilot Guest House or to Zone Officer Noel Hanson, VK2AHH, Ryan Av., Kempsey, setting out the requirements. Stretchers can be made available to persons wishing to camp. A caravan park with full facilities is also a feature of the town.

Urunga is renowned as a tourist centre, golf, bowls, fishing, swimming are all sports that may be followed if one tires of talking or acting amateur radio.

Full details of the convention will be presented over the VK2WI weekly broadcast.

OFFICIAL LIST OF COUNTRIES AND PREFIXES

THE following is the latest list of countries and their allotted prefixes. A number of changes were made during the past year and DX listings have added interest due to the re-entrance of the UA1 to UR2 stations into the DX field.

A listener needs a country list close by with the DX stations that can be heard on the HF bands these days.

AC3—Sikkim, AC4—Tibet. AC5—Bhutan, AP—Pakistan, BV (C3)—Formosa, C (unofficial)—China, C3—see BV, C9—Manchuria, CE—Chile, CE9, KC4, LU-Z, VP1, VP8—Antarctica, CE0—Easter Island, CM, CO—Cuba, CN2, KT4—Tangier Zone, CN8—French Morocco, CP—Bolivia, CR4—Cape Verde Is., CR5—Portuguese Guinea, CR5—Principe Sao Thome, CR6—Angola, CR7—Mozambique, CR8—Goa (Portuguese India), CR9—Macao, CR10—Portuguese Timor, CT1—Portugal, CT2—Azores, CT3—Madeira Is., CX—Uruguay, DJ, DL, DM—Germany, DU—Philippine Is., EA—Spain, EA6—Balearic Is., EA8—Canary Is., FA9—Ifni, EA9—Rio de Oro, EA9—Spanish Morocco, EA0—Spanish Guinea, EI—Republic of Ireland, EL—Liberia, EQ—Iran, ET2—Eritrea, ET3—Ethiopia, F—France, FA—Algeria, FB8—Amsterdam and St Paul Is., FB8—Comoro Is., FB8—Kerguelen Is., FB8—Madagascar, FB8—Tromelin Is., FC—Corsica, FD—French Togoland, FE8—French Cameroons, FF8—French West Africa, FG—Guadeloupe, FH—French Indo China, FK8—New Caledonia, FL8—French Somaliland, FM—Martinique, FN—French India, FO8—Clipperton Is., FO8—French Oceania (e.g. Tahiti), FP8—St. Pierre and Miquelon Is., FQ8—French Equatorial Africa, FR7—St. Martin, FU8, YJ—New Hebrides, FW8—Wallis and Futuna Is., FY7—French Guiana and Inini, G—England, GC—Channel Is., GD—Isle of Man, GI—Northern Ireland, GM—Scotland, GW—Wales, HA—Hungary, HB1, 9—Switzerland, HC—Ecuador, HC8—Galapagos Islands, HE—Liechtenstein, HH—Haiti, HI — Dominican Republic, HK — Colombia, HKO—Archipelago of San Andres and Providencia, HL—Korea, HP—Panama, HR—Honduras, HS—Siam, HV—Vatican City, HZ—Saudi Arabia, I—Italy, II—Trieste. 15—Italian Somaliland, IS1—Sardinia.

JA, KA—Japan, JY, ZC7—Jordan, JZ0—Netherlands New Guinea, K, W—USA, KC4—see JA, KAO—Bonin and Volcano Is., KB6—Baker, Howland and American Phoenix Is., KC4—see CE9, KC4—Navassa Is., KC6—Eastern Caroline Is., KC6—Western Caroline Is., KG1—see OX, KG4—Guantanamo Bay, KG6—Mariana Is., KH6—Hawaiian Is., K16—Johnston Is., KL7—Alaska, KM6—Midway Is., KP4—Puerto Rico, KP6—Palmyra Group, Jarvis Is., KR6—Ryukyu Is (Okinawa), KS4—Swan Island, KS6—American Samoa, KT1—see CNZ, KV4—Virgin Is., KW6—Wake Is., KX6—Marshall Is., KZ5—Canal Zone, LA, LB—Jan Mayen, LA, LB—Norway, LA, LB—Svalbard (Spitzbergen), LU—Argentina, LU-Z—see CE9, VP8, LX—Luxembourg, LZ—Bulgaria, M1—San Marino, MP4—Bahrein Is., MP4—Kuwait, MP4—Qatar, MP4—Trucial Oman, MS4—see I5, OA—Peru, OD5—Lebanon, OE—Austria, OH—Finland, OHO—Aland Is., OK—Czechoslovakia, ON4—Belgium, OQ5, O—Belgian Congo, OX, KG1—Greenland, OY—Faeroes, OZ—Denmark, PAO—Netherlands, PJ2—Netherland West Indies, PJ2M—Sint Maarten, PK1, 2, 3—Java, PK4—Sumatra, PK5—Netherlands Borneo. PK6—Celebes and Molucca Is., PX—Andora, PY—Brazil PZ1—Netherlands Guinana, SM—Sweden, SP—Poland, ST—Sudan, SU—Egypt, SV—Crete, SV—Dodecanese (e.g. Rhodes), SV—Greece, TA—Turkey, TF—Iceland, TG—Guatemala, TI—Costa Rica, TI9—Cocos Islands (Pacific).

UA1, 3, 4, 6 European Russian Socialist Federated Soviet Republic, UA1—Franz Josephland, UA9, 0—Asiatic Russian SFSR, UB5—Ukraine, UC2—White Russian Soviet Socialist Republic, UD6—Azerbayan, UF6—Georgia, UG6—Armenia, UH8—Turkoman, UI8—Uzbek, UI8—Tadzhik, UL7—Kazakh, UN1—Karelo—Finnish Republic, UO5—Moldavia, UP2—Lithuania, UQ2—Latvia, UR2—Estonia, VE, VO—Canada, VK—Australia (including Tasmania), VK1—see CE9, VK1—Heard Is., VK1—MacQuarie Is., VK9—Nauru Is., VK9—Norfolk Is., VK9—Papua Territory, VK9—Territory of New Guinea, VK9—Cocos Is. (Indian Ocean), VO—see VE, VP2—Leeward Is., VP2—Windward Is., VP3—British Guinea, VP4—Trinidad and Tobago, VP5—Cayman Is, VP5—Jamaica, VP5—Turks and Caicos Is., VP6—Barbados, VP7—Bahama Is., VP8—see CE9, VP8—Falkland Is., VP8, LU-Z—South Georgia, VP8, LU-Z—South Orkney Is., VP8, LU-Z—South Sandwich Islands, VP8, LU-Z—South Shetland Is., VP9—Bermudas, VQ1—Zanzibar, VQ2—Northern Rhodesia, VQ3—Tanganyika, VQ4—Kenya, VQ5—Uganda, VQ6—British Somaliland, VQ8—Chagos Is., VQ8—Mauritius, VQ9—Seychelles, VR1—British Phoenix Is., VR1—Gilbert and Ellice and Ocean Is., VR2—Fiji, VR3—Fanning and Christmas Is., VR4—Solomon Is., VR5—Tonga (Friendly Is.), VR6—Pitcairn Is., VS1—Singapore, VS2—Malaya, VS2—Sarawak, VS5—Brunei, VS6—Hongkong, VS9—den and Soctra, VS9—Maldive Is., VS9—Sultanate of Oman, VU2—India. VU4—Laccadive Is., VU5—Andaman and Nicobar Is., W—see K, XE—Mexico, XE4—Revilla Gigedo, XW8—Laos, XZ2—Burma, YA—Afghanistan, YI—Iraq, YI—see FI8, YK—Syria, YN—Nicaragua, YO—Roumania, YS—Salvador, YU—Yugoslavia, YV0—Aves Is., ZA—Albania. ZB1—Malta ZB2—Gibraltar, ZC2—Cocos Is. (Indian Ocean), ZC3—Christmas Is. (Indian Ocean), ZC4—Cyprus, ZC5—British North Borneo, ZC6—Palestine, ZC7—see JY, ZD1—Sierra Leone, ZD2—Nigeria, ZD3—Gambia, ZD4—Gold Coast, Togoland, ZD6—Nyasaland, ZD7—St. Helena, ZD8—ascension Is., ZD9—Tristan da Cunha and Gough Is., ZE—Southern Rhodesia, ZK1—Cook Islands, ZK2—Niuve, ZL—Kermadec Islands, ZL—New Zealand, ZM6—British Samoa, ZM7—Tokelau Union) Is. ZP—Paraguay, ZS1, 2, 4, 5, 6—South Africa, ZS2—Prince Edward and Marion Is., ZS3—South West Africa, ZS7—Swaziland ZS8—Basutoland, ZS9—Bechuanaland, 3A—Monaco, 3V8—Tunisia, 4C7—Ceylon, 4W1—Yemen, 4X4—Israel, 5A—Libya, 9S4—Saar, Countries without prefixes, Aldaba Is., Cambodia, Mongolia, Nepal, Viet Nam and Wrangel Is.

The VK1 prefix for Antarctica, Heard and Macquarie Is., will soon be changed to VK0.

In the case of LU-Z stations their location can be identified by the final letter of their call. Calls ending in A, G, M are in the South Orkneys; C, I O, in the South Shetlands; B, D, E, F, H, J, K, L, M, N, P, Q, R, W are in Antarctica. LU7ZB, for instance, would be in Antarctica. As most of the above stations are located in disputed areas cards from them are not acceptable for British awards.

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DX Awards

CTICALLY every month brings forth a w DX operating award, some of these fficult to gain, others just impossible for erage amateur.

s a pity so many of these awards are ing. Most national societies provide awards ne form or other and theirs are of some ig among amateurs. Entering the field awards these days are many minor radio and societies and magazines, the latter with ea of boosting circulation. The issuing of ates for amateur operating prowess could to national bodies.

number of these awards available to rs is in excess of 200 issued in all parts globe, the detailed rules of them all fill a large book. Rules of some awards to vary regularly making it difficult to be sant with the latest award requirements.

influx must end one day and enough for the shack walls can be acquired if you for the primary certificates WAC, WBE, WAZ, EDX, etc., and forget the secondary ation.

★ ★ ★

On the 21 Mc Band

the moment with the 21 Mc band providg signals from all parts of the globe at hours of the day Novice Licencees in the re complaining of the interference from as telephony stations. Novice stations have cial allocation on the 21 Mc band from to 21300 Kc. and it is in this segment most telephony stations overseas from the perate. Novice stations have crowded to w end in an endeavor to keep clear from ony stations. During the next few years s will undoubtedly be in trouble on the band.

Perhaps an allocation can be found for them the 28 Mc band where the interference nce is somewhat lower.

ew of the lesser known prefixes in Africa been heard in the early evenings on 14 Gordon Cole, VK2DI, contacted ZD3A 30 EAST and ZD9AE was heard at 2115 ZD9AF is reported to be operating d 1700 hours. Gordon has received a card direct through the mail, and other rds are arriving through the QSL Bureaux

★ ★ ★

Phone Allocations

The ARRL has petitioned the Federal Communications Commission with a request that sections in the US be varied to provide a ter telephony allocation for US stations the 14 Mc band.

The league asked that the current telephony ent be extended to the high end of the and to read from 14200 to 14350 Kc. a extension.

It was pointed out that although the 21 Mc was wide open for world contacts and the ony segment was fully occupied no reon in activity on the 14 Mc telephony band noted.

Interference in this segment is very pro ed despite the increasing use of single band techniques and it is only the more ful stations that can be copied here.

The 50 Kc segment is little used by overseas ony stations at the moment and the grant of these additional frequencies for US phone tion would greatly assist operation on the over there.

Another change that has been requested is for re-introduction of the former licensing pro de whereby most applicants for amateur ces make personal appearances for examinations.

Regulations gazetted in 1954 permitted examin to by mail of any person who was resident cess of 75 miles from the recognised examin centres. The league has observed a ssing respect for amateur licences brought by its widespread availability by mail.

The idea was originally instituted because ancial considerations and the ARRL con that no licences except the Novice class d be made available by mail except in very ted areas.

A.O.C.P. CLASS

The W.I.A., Victorian Division .O.C.P. Class will commence on Monday, 29th April, 1957. Morse nd Regulations are held on Thursay and Theory on Monday evenngs from 8 to 10 p.m. Persons esirous of being enrolled should ommunicate with the Secretary .I.A., Victorian Division, 191 ueen Street, Melbourne (Phone [Y1087 from 10 a.m. to 4 p.m.), r the Class Manager, on either of the above evenings.

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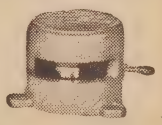

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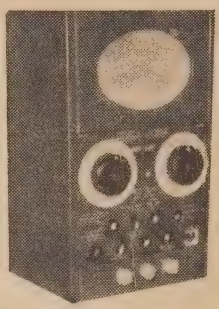
DULWICH HILL, UNDERCLIFFE, EARLWOOD.

EVENINGS and WEEKENDS: "KALUA"



AR8 COMMUNICATIONS RECEIVER

12 valve. Converted to 240v A.C.
Thoroughly Tested Re-aligned
Latest Ovaltone Permag Speaker

£34/17/6

NEW AMERICAN SELSYN MOTORS

50 volt Transmitter

£2

Slaves—£1/17/6

NEW 24V MOTORS

Series wound Hi-Speed miniature 12,000 RPM £2/10/-
Shunt wound with gear box 2 speed 5 and 25 RPM £2/10/-

NEW TELEPHONE WIRE

American 7 strand Rubber Insulated
½mile drums—15/-
CASE OF 6 DRUMS 3 MILE .. £4 0 0
DON 8 WIRE, 3 MILE .. £10 0 0

Throat Mikes New 3/6
12V 420 watt Prefocus Globes 7/6

NEW C.R.O. TUBES

All tested on TV picture

3BP1 with shield and socket £3/17/6
VCR 97 .. .. £2 17 6
ACR2X & Shield £3 0 0
CV 112 White 5" £3 10 0
CV 254 9in Blue Screen, Magnetic Deflection & Focus

£4/10/-

Every tube capable of perfect picture. Fast persistance and simple construction using standard components.

NEW AMERICAN HI-FI Dynamic Headphones

L. IMP. Padded Earpieces

£1/5/-

Postage N.S.W. 2/- Interstate 3/6

AR8-AT5 — COMPLETE STATION

AIR TESTED

Transmitter-Receiver, Aerial Coupler Cables, Plugs, Phones, Mike
1 Crystal to desired Frequency.
24V Power Supply & Circuits of 2 units
GUARANTEED IN PERFECT ORDER

£62/10/- Other voltages available

NEW B.S.R. FP10 GRAMO MOTORS

240 or 110
FOR THAT TAPE RECORDER

£1/19/6 POSTAGE 2/6

NEW VALVES

217C	£1/10/-	12K8	12/6
6J8	17/6	X61M	17/6
12C8	12/6	VT502	12/6
VT501	12/6	6E5	12/6
7C5	12/6	7A6	7/6
EBC33	12/6	AV11	3/9
1H6	7/6	832A	£3/0/0
6L6	20/-	6K7	7/6
1C6	12/6	12SJ7	12/6
1G4	12/6	12SK7	12/6
1D4	12/6	12SL7	12/6
1J6	12/6	39/44	10/0
1K4	12/6	46	12/6
1K6	12/6	47	12/6
1LH4	12/6	78	12/6
1LN5	12/6	809	22/0/0
6A6	12/6	828	£2/10/0
A4	15/	843	£1/10/0
B7	10/-	957	6/6
3D6	10/-	1625	£1/0/0
6AG5	9/6	1629	10/-
AM5	15/6	2050	£1/0/0
6AM6	17/6	1619	£1/0/0
6H6	7/6	4307A	10/-
6J6	15/-	9001	8/6
17G	9/6	9003	12/6
6N7	10/	9004	8/6
6SK7	12/6	RK75	10/-
6SL7	12/6	RK48A ..	£3/0/0
6Y6	17/6	VR75/30	15/-
10	15/-	VR105/30 ..	15/
12H6	7/6	ATP35	12/6
12A6	12/6	954	7/6
2A3	£1/0/0	1T4	12/6
KTW62/6U7 ..	7/6	1C7	7/6
5U4	12/6	1A5	7/6
1M5	7/6	7193	3/6
U5	7/6	829B	£4/10/0
CV6	3/6	6G8	15/-
6F6	12/6	EL33	12/6
813	£3/0/0	688	12/6
VR65A/SP41 ..	2/6	307	£1/-/-
KT66	27/6	EL3NG	12/6
806	£7/10/0	83	10/-
6V6	12/6	EMI	12/6
		866A	17/6

NEW ELGIN 8-DAY AIRCRA CLOCKS

Panel Mounting. 2½ in. Sweep Se
Hand. Cost RAAF £28/10/-
Ideal CAR DASH CLOCK

£7/10/- POSTAGE 2/

NEW

12V GENEMOTORS

American 12V. Input.
270V. 100 MA Output

£4/15/-

PHILIPS SIGNAL GENERATORS

101C

Thoroughly Tested and Calibrat
Guaranteed Perfect Order.

£29/10/-

New A.R.B. Receivers

8 Valve

4 Band 195 KC To 9.025 Megs.
24V D.C. Operation **£22/1(**
Converted for 240V A.C. **£33/1**

RELAYS

6v. 3 Ple Miniature 1
1700 SPDT .. ..
1300 SPDT .. ..
500 x 500 SPDT .. ..
12 volt DPDT 5 amp £1/
24 volts DPDT .. ..
8-16 volt DPDT .. ..
11 volt AC £1/
Hi-speed Polarised relay £2/1
400 ohm .. ..
1300 ohm DPDT .. ..
½in Square Section DURAL T
ING UP TO 12ft lengths 1/- per
Hi-lo Phono Transformers ..
Spirit Level Bubbles, mounted
Canadian Signal Lamps .. ..
Hi-voltage Lead-Thru Insulators
1/6 each, 15/- d
Hydrometers, Battery Testers
Torches 2-cell Focusing .. ..
Multi-Strand 4 core Cable,
Yard, 1/-; 100 yards £2/1
Tx. Var. Condensers, 300 pf £1/
100 pf £1/
60 pf with Vernier £1/
30 pf 1

★★★★★★★★ RADIO

PHONE LA 3845

6 VICTORIA RD. MARRICKVILLE. SYDNEY, N.S.W

TRAM AT DOOR. STOP 42

COLLAROY ST., COLLAROY—XW5956

A.W.A.-3.B TRANSMITTERS

12 volt operation
to 9 megs. 10 watts output
Airtested, complete with 1 crystal.

£29/10/-

NEW POWER TRANSFORMERS

x 425V 300 MA	£3/17/6
MA Chokes	£1/15/-
MA Chokes	£1/-/-

NEW COPPER OXIDE RECTIFIERS

1 amp Bridge £1/2/6

INVERTERS

6V. 12V. 24V. 32V. DC to
Watt to operate Radio, Fluorescent Lights, Shavers, etc.

£8/17/6

NEW TRANSFORMERS

FERGUSON

IBRATOR TRANSFORMERS

x 150 40MA. 6V.	£1 4 6
x 300 100 6V.	£1 17 6
x 325 125 12V.	£3 12 6

NVERTER TRANSFORMERS

240V 40 watt	£3/7/6
240V 60 watt	£3/7/6
240V 60 watt	£3/7/6

C.R.O. TRANSFORMERS

0 x 350 extended to 1000V
3V 6.3V 215V 4V **£4/5/-**
STAGE N.S.W. 5/-. INTERSTATE 7/6

TYPE 25 R.F. UNITS

w condition complete with valves makes
cellent 6 channel TV tuner

£3/17/6

NEW ALPHA SWITCHES

tary D.P.D.T.	3/9
tary D.P.S.T.	3/3

Postage 6d.

lew Coils and Intermediates

:ndard or miniature to suit all valves.

Gils B/C 455 KC	9/6
Gils S/W 455 KC	9/6
ters	11/6
op aerial coils	9/6
ig tuned H.F. coils suit 144 meg. ..	4/6

NEW

SELENIUM RECTIFIERS

500 V. Halfwave.

300 MA	£2 0 0
600 MA	£3 0 0
1.2 AMP	£5 0 0

250V In / 500V Out — **£2** — Doubler 300 MA

WANTED

Communication Receivers, Test equipment, P.A. gear. Large or small surplus stock. Best prices. Call, write or phone any time.

OIL FILLED CONDENSERS

1UF 600V. .... 6/6. 5UF 2.5 .... 6/6
4UF 750V. .. 12/6 5UF 400V. .. 6/6
10MFS 500 7.5UF 330V AC 10/-

No. 19 TRANSCEIVERS

15 valve. 2 to 8 meg. 250 meg. Complete with valves, 12V Power Supply & Circuit.
No Plugs & Cables.

£16/17/6

NEW. No. 19

2 to 8 megs as above. Converted to Crystal Control. Power increased to 20 watts. Includes Plugs & Cables, Crystal Mike, Speaker, Circuit, etc.
Crystal frequency conforms to PMG requirements for small ships and other services.

£49/17/6

813, 832, 829 SOCKETS

20/- ea. post 1/6

P.M.G. JACKS & PLUGS

4/6 pr. Post 1/-

UNIVERSITY V.C.T. UNITS

Roller value chart tested. All ranges. Perfect order.

£22/10/-

12 VOLT GENERATORS

New C.A.V. 80 amp Generators. Ideal for lighting or fast charges.

£10/10/-

Telephone Equipment

Hand sets	£1/9/6
Mike inserts	3/6
Head & breast sets	17/6
Hand sets with pressel switch	£1/15/-
Hand generators	10/-
Adjustable buzzers	7/6

Miniature telephone units to suit. Hand sets or H & B 10/-

GENEMOTOR

12V input. 2 outputs. 275V 110 MA. 550 V 55MA. Ideal for mobile stations P.A. etc.
Fully Filtered.

£6/-/-

PACKED WEIGHT, 20 LBS

NEW TELEPHONES

Bakelite P.M.G. Type Pedestal Units. Magneto Powered.

No. 11 TRANSCEIVERS 3.9 To 7.3 Megs.

9 valve 12V DC operation complete with circuit. 2 power supplies. All plugs and cables.

£10/10/-

PACKED WEIGHT, 1½ cwt.

GENEMOTORS

Input	Output		
24V	250V 100MA	£1	0 0
24V	550V 375MA	£2	0 0
24V	250V 60MA	£1	5 0
12V	500V 350MA	£8	10 0
12V	1200V 200MA	£6	10 0
6V	500V 150MA	£6	10 0
24V	250V 100 MA. New	£2	0 0
12V	300V 250 MA	£4	10 0
12V	235V 50 MA	£2	15 0
12V	350V 50 MA	£2	15 0

TRANSCEIVERS NEW CONDITION

108 battery operated pack set complete with valves and all accessories except batteries. Coverages 2.5 to 3.5 megs. For small ships, etc.

£12/10/-

Converted to Crystal control. Airtested

£22/10/-

No. 22 12V DC powered. 2 to 8 megs 10 watts output. Airtested. Complete with all accessories

£27/10/-

Converted to crystal control. Including crystal

£49/17/6

No. 11. Less valves and accessories. Ideal for parts or spares.

£3/-/-

SCR. 611. American walkie-talkies. Airtested. Complete with 2 crystals.

£22/10/-

A.E. RADIO

Amplification Communication Electronics

PHONE LA 3845

136 VICTORIA RD. MARRICKVILLE, SYDNEY, N.S.W
AND 636 KING STREET, NEWTOWN

EVENINGS and WEEKENDS: "KALUA", COLLAROY ST., COLLAROY — XW595
DULWICH HILL, UNDERCLIFFE, EARLWOOD, TRAM AT DOOR, STOP No. 42

8 VALVE RADIOGRAM HI-FI CHASSIS

Dual wave, bass & treble boost tuned R.F stage 12" speaker.

£28/17/6

5 VALVE RADIOGRAM CHASSIS

DUAL WAVE 12in SPEAKER

£18/15/0

5 valve also available as home constructor's Kitset **COMPLETE WITH CIRCUIT £14/15/0**

7 VALVE DX RECEIVER

3 band, 2 to 6 to 18 megs 160 to 16 meters and broadcast. Exceptional selectivity, sensitivity 2 microvolts. **NEW AUSTRALIANS,** listen to European short wave stations.

£29/17/6

PUBLIC ADDRESS RANGE 240-AC

6 valve	10 watt	£14/17/6
6 valve	25 watt	£25/ 7/6
6 valve	40 watt	£32/ 7/6

BATTERY ONLY OPERATION

6 valve 6 volt 10 watt **£18/15/-**
7 vavle 12 volt 10 watt **£19/15**
7 valve 12V. 25 watt **£24/17/6**

BATTERY AND A.C. OPERATION

6 valve 10 watt 6V. **£20/15/-**
7 valve 12 watt 12V. **£21/15/-**
7 valve 25 watt 12V. **£29/7/6**

HI-FI RANGE

MULLARD 5/10.

£34/15/0

Complete with Jensen twin cone speaker, Ferguson O.P. transformer, 301 & U.L. taps.

MULLARD 5/20 AS ABOVE

£42/15/0

Tuner & separate control box with mike, pre-amplifier.

£12 extra

THE FINEST SET AT ANY PRICE

CHECK THESE EXTRA FACILITIES

Built-in Preamplifier to suit crystal microphone tape deck, electronic guitar, sound on film, TV, etc.

Hear it demonstrated on these units.

DEMONSTRATIONS EVERY SUNDAY 2 to 5 p.m.

OR EVENINGS. BY PHONE APPOINTMENT

AT **COLLAROY**

PHONE XW5956

CABINETS AND ALL ACCESSORIES TO SUIT

THE OUTSTANDING 10-VALVE HI-FI

RADIOGRAM CHASSIS

Incorporating Mullard 5/10 bass boost amplifier, treble boost dual wave tuned R.F. stage. Built-in pre-amplifier for microphone or tape recorder including Jensen twin speaker.

£44'15'0

Dual wave, 6 valve radiogram chassis includes bass & treble boost, 12" Jensen or Magnavox speaker.

£23/15/0

TV EQUIPMENT

Formers in cans with special V.H tuning slugs and winding data for vi and sound I.F.S. and traps 6/6
E.H.T. Transformers for 3000v, £1/15/ 5000v insulation Fil Transformers £2/-/
Video and sound I.F.S. ratio detect and traps to A.W.A. circuit specificati Pre-aligned 19/6
Wired and tested video and sound strip with traps and ratio detector incl ing valves and circuit. Including val £21/
Wired and tested. Strip as above using new ex-disposal valves and circ etc. £17/
N.B. All equipment complies with P.M. specifications.
Turrets, line transformers, yokes, deflect coils and standard 17" tubes availab
Also first class technical and alignm service.
Coils and IFS etc. Including chassis sockets and circuit for Steans video sound strip £6/1

3 SPEED PLAYERS

All makes from

£11/17/6

3 SPEED CHANGERS

£15/17/6

Portable carrying cases, £4/17/6, Players. Changer £6/15/-

CAR RADIO

A complete range for 6V or 12 as required. Standard fitting

5 valve	£30/9/0
6 valve	£35/14/0

Tailored to fit late model car

5 valve	£35/14/0
6 valve	£43/2/0
8 valve	£52/10/0

All installation fittings, sup pressors, aerials etc. are in cluded.

AMPLIFIER AND P.A. HIRE SERVICE

Public Address Equipment for all pu poses from the smallest party to t largest sporting function.
Skilled operators & commentators
Get our quote
Phone LA3845 - After Hours - XW59

IRD — THE MAN WHO WAS FIRST

(Continued from Page 7)

d officially for color in the
nd for a time it was the only
proved by the FCC in that

once again electronics was the
nd the whirling disc was eclipsed
last time.
beauty of Baird's system was
parative ease with which it could
pted and elaborated for color.
obvious to him that, if he could
his colors from three primaries
same way that everybody else
could get what he wanted. All
to do was to send out three
ve picture frames, one in red,
blue and one in green. If these
pictures were viewed quickly
the illusion of color should
plete.
this he did by the process of
disc which had three sets of
holes instead of one.

S FOR COLOR

s were used to ensure that each
three sets transmitted only its
olored light.
at the receiving end, two lamps
sed, the neon to provide red,
mercury and helium vapor lamp
en and blue.
g this system Baird gave a
stration about which one writer
magazine "Nature" could say this.
color images we saw were
ivid. Delphiniums and carnations
d in their natural colors, and a
of strawberries showed the red
very clearly."
that only one channel was
ry for color, and that the idea
have quite well been used for a
ible system if so needed.
fact this was one reason why,
0 years later, the USA proposed
it themselves.
oscopic TV, which was to have
t a full 3D effect to viewers, was
t thing for Baird to accomplish.
he was faced with the same
ty which apparently has wrecked
) ideas to date—to provide a
e picture for each eye, and some
kind of viewing mechanism to separate them.

Actually the invention of the old type stereoscope had done most of Baird's work for him—all he had to do was to provide two pictures instead of one by using two sets of holes in his discs.

Each set of holes scanned the object with a displacement of several inches, and each sent out a picture which used the transmitting channel for alternate frames.

At the receiving end, therefore, there were two pictures received instead of one, and these were viewed through a stereoscope which combined the two TV pictures in the same way as it had been doing with its own special photographs for many years past.

Baird had great hopes, both for color TV and stereoscopic viewing. When I spoke to him in 1938 in Australia, he made it clear that, to him, this was the ultimate presentation he hoped to achieve, although the methods he intended to use went no further than those described here.

It is obvious that stereoscopic TV in color would have called for a disc which not only provided for two pictures, but for each picture to be made up of three separate framings. It takes little imagination to realise that, except for very crude pictures of comparatively few lines, such discs would become unmanageable.

RECORDING TV PROGRAMMES

The recording of TV programs on magnetic tape is another of the latest developments of the art, and one in which not all the difficulties have yet been solved.

One reason is the huge bandwidth involved by a picture of modern definition standards—huge by comparison with the requirements of sound for which tape was originally developed.

Baird's pictures were so crude that the bandwidth involved was less than 10 kc and with the development of electrical recording, it became practicable to use ordinary disc apparatus to record them.

Once the TV signals had been converted into electrical impulses as used to modulate the transmitter, there was no reason why, in that form, they should not be fed into an electrical disc recording head, and used to cut a pattern for the grooves of a record.

If such a record were to be played back with a suitably good electrical pick-up, the grooves would cause the pick-up to generate electrical impulses essentially similar to those originally produced by the TV transmitter, and these could be used to modulate the transmitter at some future date.

The TV program which was hidden in the record grooves was brought back to life.

It would not be possible to use records for modern TV programs.

Today the bandwidth required is measured in megacycles, not kilocycles.

That is why very special techniques have been developed with tape mechanisms which seem to hold the only practicable method of recording TV programs today, apart of course from the normal cine film which requires all the processes of film preparation, developing and printing.

RONETTE

PHONES & ACCESSORIES

£9/5/11

Complete with flexible arm.

Technical pamphlets will be mailed on request. Other types also available from

Newton McLaren Ltd.

17 LEIGH ST., ADELAIDE.
and leading wholesalers

The RADIOMASTER

RADIOGRAM CHASSIS . . .

A great performer on Radio and Records

HI-FI MODEL E22 reproduces perfect high treble notes and bass notes without "drumming" or distortion — brings recorded sound to your home as near as possible to the original. A high gain R.F. stage ensures satisfactory long distance radio reception regardless of location. Features include:—

- *Treble and bass boost with separate controls*
- *Two matched Jensen speakers (12in and 6in) with crossover network*
- *Eight valves, world range.*
- *Push-pull output—inverse feed-back.*
- *Radio-gramophone switch.*
- *Provision for tape recorder.*
- *Latest type Radiotron valves.*
- *Straight line dial in four colours. size 12¼in by 7¼in.*
- *Custom built — six months' guarantee.*
- *Frequency coverage: 40 to 13,500 cycles.*
- *Design tested and approved by the Valve Application Division of Amalgamated Wireless (A'sia) Ltd.*

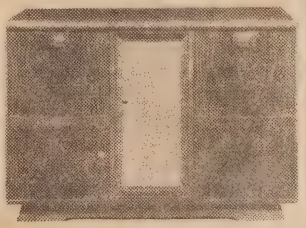
PRICE £40/15/-

Magic Eye tuning indicator 25/- extra. Packing included. Freight extra.

Other Radiomaster Radiogram chassis are available from Write for particulars £22/15/-

SPEAKER ENCLOSURES

RADIOGRAM CABINETS



Many popular designs available including contemporary in natural maple.

NEW CABINET MODELS FOR HI-FI CHASSIS incorporate vented speaker enclosures which provide for dual speakers in separate compartments, with "woofer" compartment felt lined and draped. First-class finish.

ALL TYPES OF THREE-SPEED RADIOGRAM UNITS

WRITE FOR CATALOGUE

H. B. Radio Products

103-105 Catherine Street, Leichhardt, SYDNEY

Telephone: LM5580

Established 25 Years.

NEW VALVES

6AC7	3/11	6J6	12/6	866A	15/-	806	£7/10/-
6SH7	5/-	6AK5	15/-	83	10/-	829B	£4/10/-
6H6	3/11	6X5GT	12/6	EL33	12/6	828	£1/15/-
1A7GT	9/6	6Y6	10/-	CV6	3/-	100TH	£2/17/6
1Q5	9/6	6K8G	11/6	6F6	9/6	EZ82	9/6
1T4	13/6	71A	7/6	EL32	9/6	117N7	15/-
1R5	15/-	EK32	15/-	12A6	12/6	4307A	10/-
1S5	15/-	6J8	15/-	6J7	8/6	5Y3GT	12/6
3S4	15/-	6K7	7/6	5U4	12/6	12SR7	3/6
3V4	15/-	KTW62/6U7	7/6	954	5/6	1H6	7/6
1K5	2/6	EF8	9/6	955	5/6	1J6	7/6
1L5	9/6	7C7	3/6	VR65A	2/6	1D8GT	10/-
1C7	9/6	7A6	3/6	EBC33	9/6	1D5	9/6
6U7G	7/6	78	7/6	AV11	5/-	9001	5/-
6G8G	11/6	6AG5	10/6			81	15/-
6SA7	9/6	6B8 Metal	12/6				
6SQ7	9/6	32	8/-				

ALL VALVE PRICES PLUS POSTAGE

RELAY-TYPE COUNTERS

("Mercury" American Made) These relay counters register from 0 to 99,999. Can be supplied with 250-ohm coil. 24v D.C. operation.

25/-

Plus Postage.

NEW 5-VALVE D.W. VIBRATOR CHASSIS

These Chassis, by leading manufacturer, are new but shop-soiled. Are supplied in working order and complete with valves, Rola 6in x 9in Oval Speaker. Slide Dial and Vibrator, supply (6v).

List Price over £40.

SPECIAL PRICE,

£15/15/- F.O.R.

Ideal for Boat, Caravan, etc.

NEW AMERICAN INDICATOR UNITS

Containing 12 Valves, 1, 3 B.P.I. in Separate Shield, 7-6SN7, 1-2x2, 1-6x5, 1-6H6, 1-6G6.

£8/17/6 F.O.R.

T.V. COMPONENTS

All RCS Television coils. formers and transformers in stock.

A.C. AMP. METERS

A.C. Amp. Meters (ex-County Council). A necessity in any electricity workshop.

RANGE: 0-5 amps. (can be extended by shunts). DIAMETER: 7½ inches.

28/6 F.O.R.

By Rail or Air Freight Only

Too heavy for Post

FOUR-VALVE AMPLIFIER

Four-valve audio amplifier, made in America. Supplied with two 7C5, one 7F7 and one 7Y4 valves, trans, res., etc. mounted in brocaded finished case

Post N.S.W. 5/6
INT. 7/6

38/6

NEW AMERICAN BOX KITES

These kites are constructed of Silk with Metal Frame.

SIZE 15in square x 3 ft long.

Originally used for Aerials for Lifeboat Transmitters.

30/- Post 2/-.

NEW 1000 K.C. CRYSTALS

For Bendix Frequency Meters. Made by General Electric. American Octal Base.

£7/15/-

P.M.G. TYPE RELAY-COUNTER

0-9,999

1300 ohm coil **15/-**

NEW ENGLISH T.C.C. PAPER CONDENSERS

.01-1000V .. .. **1/9 ea.**
.05-1000V .. .. **1/9 ea.**
.1-1500V .. .. **2/6 ea.**

Post Extra.

SWITCHBOARD LINE UNITS

Containing metal rectifier, 50V, 100mA, sensitive relay, bezel light, phone jacks, etc.

6/9—Post 2/6.

24-VOLT MIDGET MOTORS SHUNT WOUND

Fully Laminated Field Wound Armature. Sixteen Segment Commutator, ball bearing. Ideal for Model Trains. Hobbyists, etc. Condition New.

Price, each **32/6**

Packing and postage: N.S.W., 1/6; Interstate, 2/6

ROTARY-CONVERTERS

24 to 32 Volt D.C., Input, Output, 240 Volt 50 Cycles at 150 Watts, Suitable for Tape Recorders, Radiograms, Amplifiers, etc.

£14/15/- F.O.R.

NEW PUSH-BUTTON SWITCHES 20/-

Five pole push-button switches .. .. New control box fitted with above switch also 5 bezels with globes and multi contact key switch.

Post: N.S.W. .. 2/-
Int. 3/-

NEW B.S.R. MOTORS

These English B.S.R. Motors as used on most tape decks, also have many other uses. Size of motor 3in x 2½in x 2¼in with 3/16in shaft, for 240 or 110 volt AC. operation NEW **39/6**

Used, but in good condition **27/6**

Post: N.S.W., 3/-; Interstate, 4/6

NEW GRAMO MOTORS

New H.M.V. spring gramo motors, less turntable. Adaptable for many uses **19/6**

Postage: N.S.W., 4/6; Interstate, 7/6

CERAMIC TRIMMER CONDENSERS

Small 7-plate 0-20 PF **3/6**
Small Tubular, 0-20 PF **2/-**

Please address all correspondence to 479 Parramatta Road, Leichhardt, N.S.W.

METROPOLITAN RADIO SUPPLIES

640 KING STREET, ST. PETERS, NSW
PHONE LA 6087

479 PARRAMATTA ROAD,
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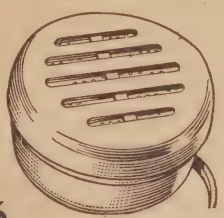

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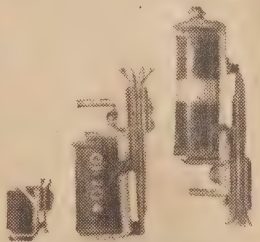

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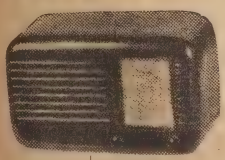

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NSWERS TO CORRESPONDENTS

. **(Marrickville, NSW)** asks a number ons to do with audio.

appreciate that there is a wide interest and that many people would welcome of audio circuits, amplifiers, etc. Pos- will be able to publish such a book t at the moment cannot make any promises. Power transformers can be speaker transformers under certain con- it even when the turns ratio is correct frequently be found that the primary e is not suitable or that leakage in- and distributed capacitance are too extended response. Your 80mA power er would really not be big enough crystal pickup amplifier described in 1954, issue. However, if you do not buy a new transformer, the bias resistor for the 6BQ5. 6BV7's could be increased until the sin is within ratings. A mA meter with the transformer centre tap would test indicator of the correct value. We use valve operating conditions other standard published conditions which ount for the higher value cathode bias In this case our object ave current. Your suggestion regarding metal chassis plates separated by wooden ith the object of reducing stray AC in the chassis is in order but in prac- is usually cheaper and easier to adopt precautions rather than mechanical preamplifier stage is not critical fields it may have to be placed well m power transformers, etc., regardless properties of the chassis.

(Indooroopilly, Q) sends a circuit of sted one-valve and transistor combina- ended to operate from 9 volts HT, and opinion of it.

you say, P.A.S., the arrangement is unconventional and we doubt very hether it would be successful. A far pproach would seem to be the use of ple step down transformer as a coupling which would not only isolate the from unwanted DC voltage, but also e a signal at a more suitable impedance. ng the old style receiver, we regret is almost impossible to say what might ault and, we can only suggest that some be made to establish just which stage ing. It will probably call for more nt and experience than is available at but there is no harm in trying with r equipment you have.

C. (Wallsend, NSW) comments on the wer Supply described in the January nd sends a circuit for a high voltage which he suggests may be useful for easurements.

any thanks for your contribution, J.C.R., will file your circuit for possible use Reader Built It section. Your com- garding acknowledgement has been duly At the same time we did not intend y in the original article that there was at difficulty about this measurement. In is quite simple provided the few pre- mentioned were carefully observed.

F (Terang, Vic.) suggests modifying a stan- rret tuning unit to operate as a two- oosting RF amplifier for television re- operating in remote areas. He includes iagrams showing how the turret can alled close to the aerial and switched hannel to channel by remote control.

tany thanks for the suggestion. It may we will be able to make use of the h the "Reader Built It" section of the e at some future date. The catch is, rse, whether such a booster will have signal-to-noise ratio than the circuits it ients. If not, it may not be of any dvantage.

M. (Moonah, Tas.) has a query regard- elaborate audio system he is planning. ounds very interesting, P.G.M., but we that we must stick to the rules of the service published on this page and there- annot offer the assistance you would like. uld take a good deal of investigation to h the suitability of the recorder, motor itter for use with one another and with ers which have been described in R T The modifications to allow easy change nolay to tape-record and disc-record could te extensive.

K. (Mascot, NSW) forwards the circuit of ple amplifier he wishes to use for tape ing.

Without wishing to be discouraging, we t think that results with the amplifier ave in mind would be very good. First it is necessary to have a high frequency or any sort of worthwhile results and practical recording head is quite a pre- evice which should be made with a good lf care. There are one or two doubtful about your amplifier circuit also. No on is made for a gain control and you have not provided for bias for the first amplifier stage.

E.C.W. (Christchurch, NZ) submits an idea to prevent slip between adjacent records when stacked on a record changer and enquires whether we consider it a practical one from a manufacturing point of view.

A. Not being record manufacturers, E.C.W., we wouldn't like to commit ourselves too far. However, we think the idea worthy of some consideration and we suggest you get in touch with one of the record companies.

G.J.M. (Christchurch, NZ) has an 8mm projector and wants to add a magnetic sound system to it. He asks whether we can assist him with the circuit for an amplifier.

A. Not really, G.J.M. We have described one or two tape recorder circuits but mainly intended for full-track standard tapes. You would probably need a good deal more gain than is available with such circuits. We suggest that you enquire from firms dealing with such gear or try to make contact with some film group or an enthusiast who has already worked out a practical system.

F.R. (Canley Vale, NSW) wants some information regarding the building of a morse code transmitter and a shortwave receiver. Also information on the design of aerials and how messages are sent by morse code.

A. This is rather a tall order, F.P., and we do not normally cover such broad subjects in our query service. We also feel that you will need to acquire a lot more experience before you can tackle projects of this kind. The best start would be a simple short-wave receiver such as the Junior DX-er (October, 1954). For data on transmitters we suggest a text book such as the ARRL Handbook, available from most large bookstalls.

G.F.E. (Yungaburra, Q) writes to tell us of his experiences with the No. 6 Control Unit and to suggest that a double section decoupling circuit will give greater freedom from motor-boating troubles than the original single section arrangement.

A. As you point out, G.F.E., such troubles are only likely under extreme conditions of operation, though we admit that they are no less undesirable for that reason. It appears that slight differences in the regulation characteristic of the main amplifier can mean the difference between complete stability and a tendency to motor-boat. In the case of the original unit there was no such trouble. However, we agree that the extra section would provide an additional margin of safety and is fully justified if trouble is experienced. Many thanks for your trouble in drawing our attention to this point and also for your kind remarks about the magazine.

F.C. (Carnegie, Vic.) expresses his appreciation of our journal and suggests that we publish more articles on tape recorders, particularly one that may be added to the Playmaster range.

A. We have described two tape recorders and tape adaptors in past issues. The adapter units are suitable for use with any of the Playmaster amplifiers. We have considered describing a complete new tape recorder, but, due to the pressing demands of Television and allied subjects on the staff, we have been unable to do so. However, we hope to rectify this in the not too distant future.

R.L. (Christchurch, NZ) has a high output pickup which he now wishes to use with a Williamson amplifier and Baxandall tone control. He suggests using the No. 6 Control Unit, as he claims that on past experiences the No. 2 Control Unit is too insensitive.

A. As you suggested, our immediate reaction to your problem was to suggest a control unit like the No. 2 and we are at a loss to understand why this was not satisfactory, if the figures you quote are correct. This control unit should have had no difficulty in driving any of the Playmaster amplifiers to full output from any pickup with an output of 100mV or higher. We can only suggest that the pickup is not delivering its rated output or that the control unit or amplifier is not working correctly. It would seem desirable to clarify this point before going to the trouble of making a new control unit.

If you decide to use portion of the No. 6 Control Unit, we suggest that you establish suitable value for the feedback resistors experimentally, since there are too many variables involved to permit calculating them with any degree of accuracy. The resistors should be set so that the main amplifier can just be loaded up to full output (for the required maximum output) with the gain control fully advanced and with a lightly recorded disc.

It is quite feasible to use a crystal type tuner ahead of a sensitive amplifier, provided the listening location is good enough. It is wrong to assume, however, that crystal sets are automatically "high-fidelity" devices. Non-linear effects can occur in the detectors, as in any other receiver, not to mention the well-known problems of lack of gain and sensitivity.

W.W. (Roseville, N.S.W.) writes to the Serviceman to comment on the recent article covering the guarantee on valves and picture tubes. He relates an unfortunate experience with a couple of output valves on which the makers refused to accept responsibility.

A. Many thanks for your letter and comments, W.W., and we will pass your story and comments on to the Serviceman. He will no doubt comment on them as time and space permit.

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Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

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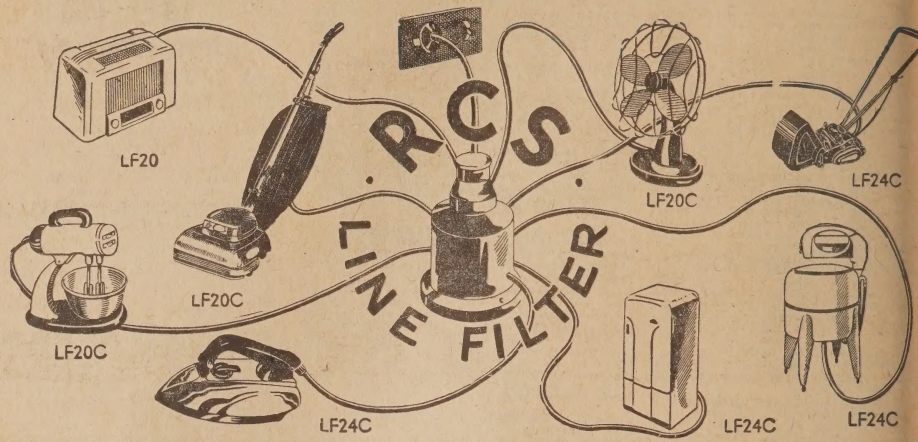

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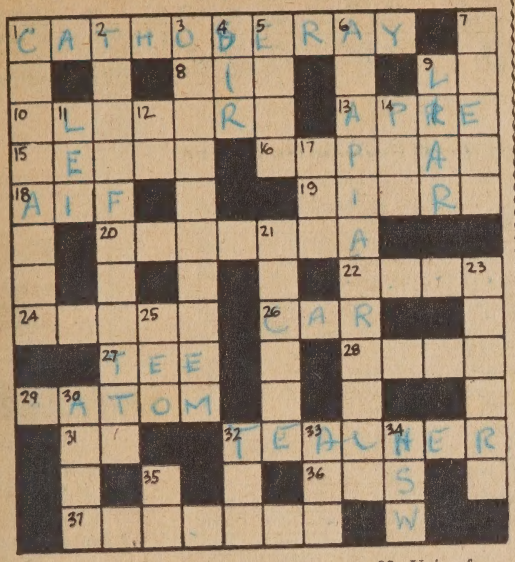


CROSS

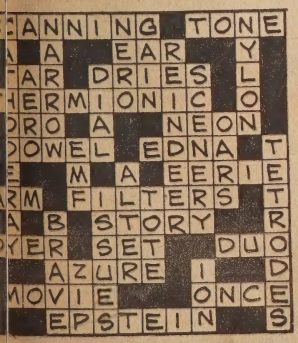
1. TV camera tube.
8. By way of.
10. French for "the" — masc.
12. Plant Blooms.
15. Seaport of Western Samoa.
16. To mention.
18. A group of four plant spores.
19. Australian Infantry Forces (abbrev.).
20. Changes direction.
21. Purified product of lac.
22. Widely used metal.
24. To move aimlessly.
25. Vehicle.
26. Golfer's requisite.
27. To cut short.
28. Closed together with cord.
29. Symbol for thorium.
30. One who instructs.
31. Belonging to it.
32. Device for checking transmission.
33. Valve output system (2 words).
34. Wires.
35. Untruthful person.
37. Necklace of flowers.

DOWN

1. Type of heat ray (2 words).
2. Make and break mechanism (3 words).
3. Said of a metal, raised to a temperature at which rapid grain growth occurs.
4. Respectful form of address.
5. A mould.
6. Valve output system (2 words).
7. Wires.
9. Untruthful person.
11. Necklace of flowers.
12. Plural pronoun.
14. Prefix meaning before.
17. Girl's name.
21. Transmission line wires used as a tuned-circuit element.
23. Unit of attenuation (pl.).
25. A payment for services.
30. Smallest particle of an element.
32. Tiny child.
33. Atmosphere.
34. New South Wales (abbrev.).
35. Prefix, forms verbs with sense of put in, into and on.

Solution and further crossword next month

ast month's solution



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A Course in Television

(Continued from page 75)

that already present across the detector load, the sum of the two forming the AGC voltage.

In other words, the AGC potential is provided by a voltage doubling circuit.

Much more could be said, even on the subject of these relatively straightforward AGC systems. However, knowing the general principles involved, the reader should now be better able to understand and evaluate the many variations which will be encountered in typical receivers.

Next article in the series will deal mainly with keyed AGC systems, as used in the more ambitious receiver designs.

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